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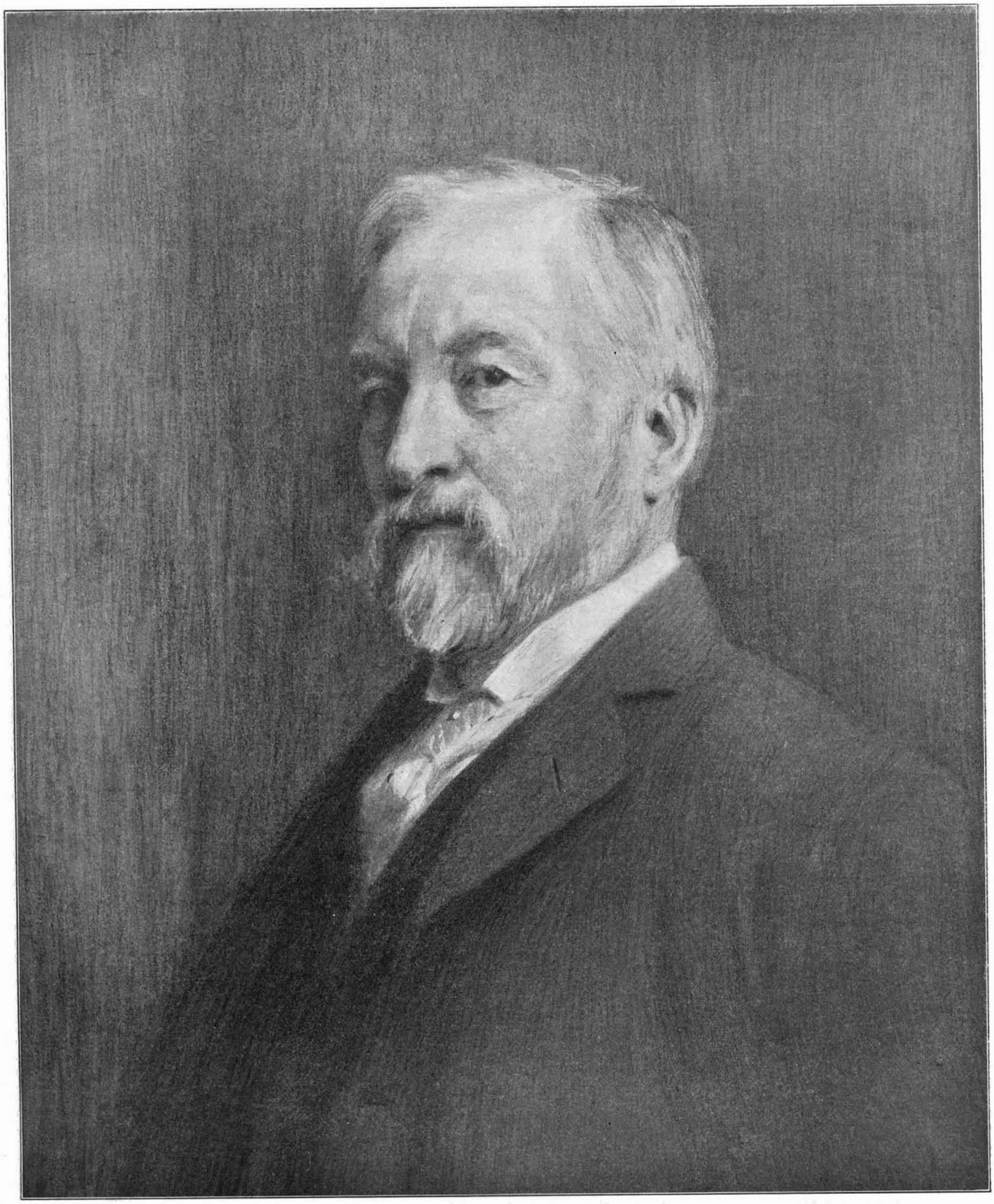

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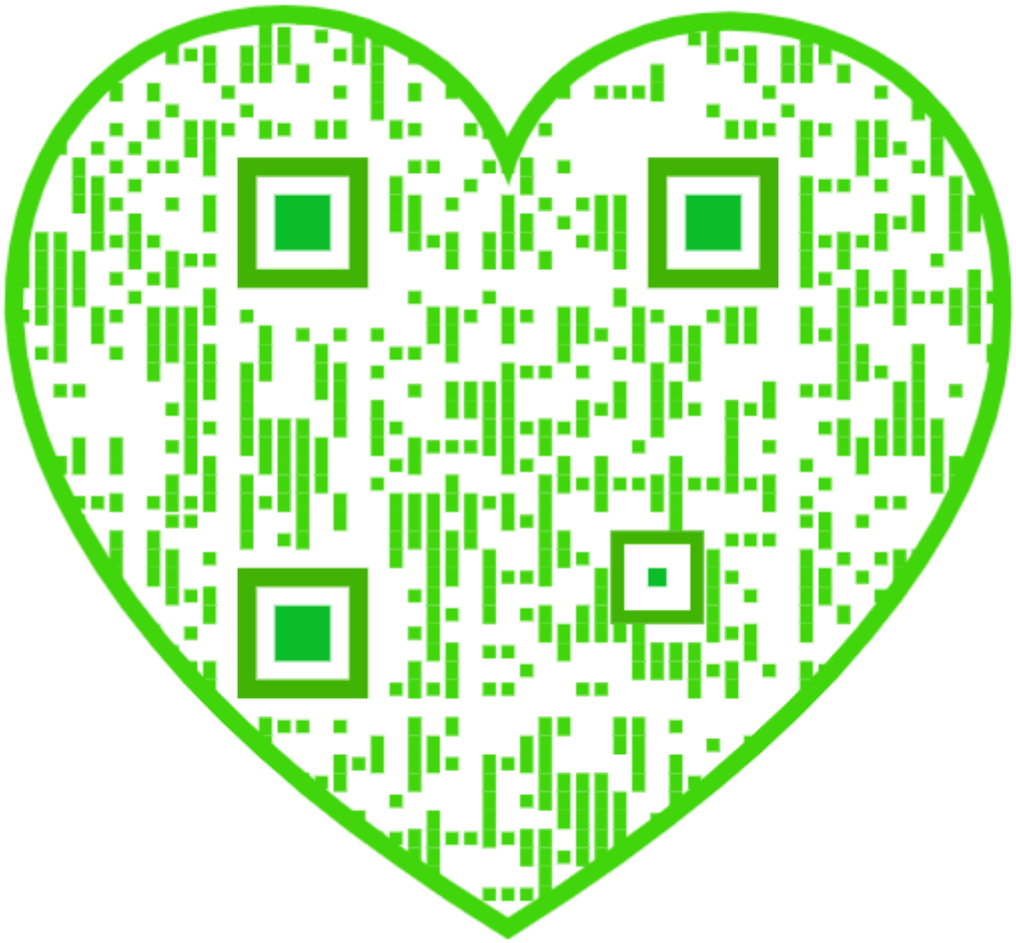

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NEW YORK, SATURDAY, MARCH 5, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE HIGH-SPEED MOTOR-BOAT MODEL.

The growing popularity of the high-speed motor boat is shown by the fact that an exhibition devoted entirely to small power-driven vessels of high speed has recently been held in this city in which an excellent exhibit was made of some of the latest and fastest of these craft and of the most approved types of engine used for their propulsion. The cause of the extremely high speed that is developed by these boats is twofold. In the first place, it is due to the introduction and refinement of a new principle of modeling developed during the past few years, which is an entire departure in some respects from the accepted speed lines for fast vessels which have governed designers ever since the modeling of high-speed craft was placed upon a scientific basis. The other cause is to be found in the remarkable development of the gas engine, resulting in the production of a given horse power for a minimum amount of dead weight. It is the simultaneous production of a high-speed model and an ideal motor to drive it that is responsible for the widespread interest in this fascinating form of sport.

The credit for the development of what might be called, for want of a more descriptive term, the motor-boat model, is shared equally by the yacht designers of the old and the new world; and we say this without any disparagement of the work done by the torpedo-boat builders, such as Thornycroft and Yarrow in England, Normand in France, and Schichau in Germany. Mention should be made of the speedy craft built by Herreshoff and Mosher in this country, and the work done by Kretschmer, naval constructor of the German navy. It is difficult to say just who was the originator of the type, and it is probable that it was an evolution that was the outcome of continued experiment and trial. Kretschmer, working on independent lines in Germany, seems to have clear title to originality in his own country, where he was enabled to patent his "tetrahedral construction;" but we understand that his application in this country was denied on the ground that the same principle has been in use for some years in the Mosher boats. In this connection we may mention that in the current issue of the SUPPLEMENT we publish the plans of one or two fast German launches of this design, together with a description of the principles upon which their lines were drawn.

The main object aimed at in the lines of this craft is to keep down wave-making, which at high speed is the chief cause of resistance. The water lines are practically straight from the bow almost to the stern, and the bow angle at the water line is twice as sharp as that of a boat of equal length and beam modeled on the old speed-line theories. Straight water lines are secured by placing the point of greatest beam at the extreme or almost extreme stern of the vessel, an arrangement which causes the immersed sections to vary from a sharp, deep V at the bow to a broad, shallow U at the stern. The sharp angles of the water line and the gradual change from V to U sections may be regarded as the cause of the inappreciable wave formation, since the currents of displaced water are not subjected to a constant change in direction as in ordinary boats; and when these craft are driven at full speed, only a slight bow-wave is formed and a relatively small stern-wave, while no hollowing of the water at the sides of the boat is perceptible. Another advantage is that in spite of the great sharpness of the lines, the boat has a greater beam than one of equal fineness of line built upon the ordinary model, with a corresponding gain in stability. At the same time, these vessels are extremely sensitive to any disarrangement of their trim, and if the proper trim be not preserved, there is a marked diminution of the speed.

Whether principles that have been so successful in small boats are capable of application to large ocean-going ships is, we think, open to question. This very matter of trimming would, at the outset, present considerable difficulties of a commercial and operative quality. Mr. Kretschmer, however, has been engaged in designing upon his "tetrahedral" principles an ocean-going vessel of the size of "Kaiser Wilhelm II.," and on a length of 690 feet, a beam of 78½ feet and a maximum draft forward of 24½ feet, diminishing toward the stern, he produces a ship which, with an indicated horse power of 20,000, he expects to realize a speed of 24 knots. In this connection it is interesting to note that towing tank experiments carried out by the Russian navy department at St. Petersburg have demonstrated the merits of this form for the attainment of high speed. For low speeds of 12 knots and under, no perceptible advantage is noticeable between the tetrahedral and the ordinary model; from 12 to 14 and even up to 16 knots, the towing tests showed that the tetrahedral form is at a disadvantage, since by reason of the greater amount of frictional surface presented, greater power is required for a given speed than with a ship constructed in accordance with the usual principles; but for speeds above those mentioned, where wave-making is set up, the new design gains in speed at a multiplying rate.

RAISING CARRIER PIGEONS.

The popularity of the homing, or carrier, pigeon has been greatly enhanced in the last few years by the annual races held in different parts of the country. At the present time fanciers are arranging for a race during the coming summer, which will eclipse anything heretofore attempted. The race will be for 500 miles, from Spartanburg, N. C., to Philadelphia, and over 2,000 birds are expected to enter the contest. It will be held on the Fourth of July, and in all probability most of the pigeons will cover the distance in ten hours. The present record for the flight is 1,603 yards in a minute, which in a 500-mile race should enable birds of ordinary speed to finish within ten or twelve hours.

The event will be one of a series of contests which have been held in the past ten years; but it will be the first 500-mile one in which anything like so many birds have started. In the 200-mile race of several years ago from Orangeburg, Va., 1,500 birds were liberated. In 1896 a smaller number of birds were started in the race. In this race two birds flew 614 miles in one day, and several have covered 600 miles in a day with apparent ease. The pigeons are carried to the starting place in baskets arranged especially for them, and liberated directly from the baskets if the day is favorable for an immediate start. Pigeon sheds are made to accommodate the birds for a prolonged stay in the event of unfavorable weather. The birds are shipped to the scene of the race by special cars under the direct care of the Pigeon-Flyers' Protective Association. Hundreds of birds have been lost in the past races through theft, and many owners of fine homing-pigeons have consequently been reluctant to enter their birds in the contests for fear of losing them. In the present race a uniform style of lock for the baskets will be adopted, and only the caretakers will be provided with keys. If the locks are opened or picked, and pigeons stolen, the association will investigate and prosecute the offenders.

There is no more delightful sport than pigeon racing of this character, nor any more enthusiastic sportsmen than the breeders of the homing pigeons. Clubs devoted to raising and improving the carriers are scattered in every State in the Union, and their memberships are all large; but there are tens of thousands of individual breeders who do not belong to any association. Thousands of these breeders enter their home-raised pigeons in the races and sometimes win prizes which the professionals fail to capture.

The best carrier pigeons are worth several hundred dollars in the market, and some cannot be purchased at any price. During the annual pigeon show at Madison Square Garden last year, $200 and even $300 were refused by the owners for some of their choicest pets. The average exhibited were valued at $25 and $50. Prices, however, do not stand in the way of the pigeon fancier to-day, for excellent homing pigeons can be purchased for $5 and less. One can start a loft with half a dozen breeders, and within a few seasons have all the birds desired. The loft is a simple affair where only a few birds are raised. The breeding quarters are separated from the living quarters, and a place large enough for the birds to stretch their wings is provided. The wonderful instinct of the homers is made apparent at an early age; but it is something that is partly due to training and development. A carrier pigeon that has never been released from its loft until full grown cannot find its way back over a long route. The process of training is necessary when the pigeons take their first flight.

"Home," to the carrier pigeon, is where it was born. There is no other home, although they have been trained to adopt a second home in some instances. When born in the loft, it is an easy matter for the breeder to teach the pigeon to return to it. The process of training consists simply in releasing the bird when first able to fly a short distance from the loft. The pigeon will jump into the air, and after a few circles, fly straight to the loft. In the second flight the distance is increased, and so on until the bird's education is complete. This education must be conducted by the breeder with gentleness and due consideration for the bird's feeling. If the distance for the first flight is too great for the pigeon, it will get confused, and it is liable to prove less accurate in its future flights. Each progressive step must be made for the purpose of establishing the bird's sense of distance and direction, and not to see how far it can be removed from the loft without losing the way in returning. A lost homing-pigeon is never quite the same, even after being rescued and taken home. After the bird gains full maturity and its education has been completed by the process described, it seems capable of finding its way home from almost anywhere. Birds released in Jacksonville have flown a thousand miles north to their homes without being lost.

When released, a homing-pigeon does not fly continuously unless the distance is short enough to enable it to reach home without stopping for rest. If the distance can be covered in ten or twelve hours, the pigeons apparently take little rest, but fly almost continuously until they reach their loft. In the few 1,000-mile races conducted years ago on the Atlantic sea coast from Florida to New York and Philadelphia, a number of the birds were lost, while others stopped on the way several times to rest; but the choicest birds which finished the long course were apparently on the wing most of the time, stopping possibly a few hours on the way to get food and rest. These long flights are not encouraged to any great extent any more, for the birds are not only frequently lost, but they cannot always get proper food along the route to sustain their powers. The birds have been weakened, and the effect on their health proved permanent. The 500-mile race is the favorite for long-distance birds, and 200 and 300-mile courses for the younger birds that have not yet won their laurels.

Besides being bred as pets and desirable companions, the homing-pigeons are now being used for various services. It looks very much as if their services as war messengers would soon be dispensed with, for wireless telegraphy has made the pigeons superfluous, and the extensive pigeon lofts in the military and naval services of European nations will probably soon become useless.

In peaceful pursuits, however, the homing-pigeons have in recent years become of great service. Country physicians have in many instances adopted them as messengers. A physician raises a loft of carriers for the pleasure of it, and when he visits a patient four or five miles away, he carries with him a basket containing one of his birds. If dangerous symptoms arise in the night or the following day, the pigeon is released with a message. Some physicians with long country routes carry a half a dozen or more of these pigeons on their rounds, and leave one at each place. A daily report of the different cases can thus be obtained by pigeon service at no cost to physician or patient. This service has also been extended on the large Western farms. Some farmers receive daily reports of the markets from the city in this way. There are no telephone or telegraph wires to send the messages; but the pigeons answer the purpose satisfactorily. All that is required is a trip to the city once a fortnight to carry back the birds, and some one in the city to write the reports and release the birds.

ON THE WORKING OF COMBINED COHERERS.

In a paper recently read before the French Academy of Sciences, M. A. Turpain examines the behavior of a set of several coherers connected to the same antenna. The sensitiveness of a coherer is determined by means of the distance over which a radiator is just capable of acting distinctly on the coherer. The distinctness of this action is given by the value of the current, which, after cohesion has been established, will traverse a very sensitive galvanometer. If the coherer be inserted in a closed circuit, its sensitiveness is found to be much higher than when in open circuit; in fact, at the moment of the emission of waves, one electrode only of the coherer is connected to the antenna and to one pole of the cell, the current of which is intended to traverse it, while the other electrode of the coherer is insulated. This is started by connecting the insulated electrode of the coherer to the ground and to the second pole of the battery after the waves have been emitted. If several coherers be connected in shunt, one of the electrodes of each coherer being connected to the common antenna, while the other is or is not connected to the remainder of the circuit, the following facts are stated: 1. The coherers will preserve the same relative sensitiveness, both in open and in closed circuits. 2. In order to ascertain the sensitiveness of several associated coherers, an emission of waves such that one coherer only is acted on, should be produced, all the

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coherers being in closed circuit. The operative coherer is next put in open circuit by insulating one of its electrodes, when another emission of waves is caused to act on the coherer left in closed circuit. After putting this second coherer in open circuit, the same process is continued until all the coherers to be classified have been dealt with. Experiment goes to show that the sensitiveness of each coherer is the same when used both separately and in connection with neighboring coherers experimented on at the same time. As regards, in the second place, coherers connected in series, if all the coherers be decohered, the circuit (coherers-battery-galvanometer-coherers) will include as many breaks as coherers. In order to ascertain the sensitiveness of each of the coherers, waves are produced by establishing conductive bridges connecting the mercury vessels, the distribution of which may easily be imagined, when each of the coherers taken apart is connected to the circuit (battery-galvanometer), the degree of cohesion produced by the emission of waves being thus ascertained. The connection of an antenna with a coherer electrode will augment the sensitiveness of the latter. The point of contact between the antenna and a circuit, comprising several series-connected coherers, being varied, the sensitiveness of the coherer system is thus found to undergo material alterations. The results of this experimental investigation are applied first to constructing an apparatus for recording the course of thunder storms; and, second, to designing sensitive instruments which may be utilized both in wireless telegraphy and in Hertzian wave telegraphy with conductors.

FLEETS IN THE FAR EAST—AN ENGLISH REVIEW OF THE POSITION OF RUSSIA AND JAPAN.

BY ARCHIBALD S. HURD, OF LONDON, ENGLAND.

(*Concluded from page* 171.)

As the two powers are at present, Japan had the advantage at the opening of the war, and this has been greatly enhanced by her initial success. She possesses more ships, such as her six battleships and her eight armored cruisers, of first-class fighting power, while the value of one or two of the Russian battleships and armored cruisers is problematical. Moreover, the Japanese ships are well manned with officers and men of the highest intelligence and training, while Russia has hurried her ships out to the Far East inadequately manned, especially as to mechanical ratings, which are of supreme importance. This is the present situation.

What will be the position six or eight months hence? Unless the present war is to be an unbroken succession of disasters, which is scarcely probable, Russia should at least hold her own on land, until the arrival of the five powerful battleships which are nearing completion in the Baltic yards. Her programme of shipbuilding of 1898 included seven first-class battleships. At present only two of these ships have been completed and sent to the Pacific, the "Retvisan" and the "Czarevitch," together with several armored cruisers. The five other battleships are nearly ready for sea. It is officially announced that they will be finished this year (1904) and unless the early disasters have caused a change in the Russian plans, all these vessels are to be dispatched at the earliest moment to strengthen the Far Eastern squadron. According to the official programme the following reinforcements will be sent from the Baltic to Port Arthur to join Admiral Alexieff's command in the course of this year:

Five battleships—"Imperator Alexander III." "Borodino," "Orel," "Slava," and "Kniaz Souvarow."

Two cruisers of the second class—"Jemtchug" and "Izumrud," of 3,200 tons displacement and 22½ knots speed.

Eleven torpedo boats.

The five battleships are of a most powerful type, displacing 13,500 tons of water, well armored, and armed with the following weapons of the latest manufacture:

20 12-inch breechloaders.
60 6-inch quickfirers.
100 3-inch quickfirers.
100 3 pounders.
40 1 pounders.
20 torpedo tubes.

These fine ships are improvements upon the "Czarevitch," which was illustrated recently in the SCIENTIFIC AMERICAN. It must be confessed that these ships represent most substantial reinforcements. Stated in the fewest possible words, their arrival at Port Arthur will signify that if she can repair her damaged battleships Russia has won, on paper, at least, the game she has played so skillfully for the past eight years. The "Imperator Alexander III." will be completed this spring and the others during the year. It is officially announced that the three battleships and most of the cruisers injured at Port Arthur can be repaired; and the damages as detailed in Alexieff's report are not necessarily irreparable. If Port Arthur and Vladivostock can hold out and the fleets remain under their guns until the five battleships arrive Russia will have an overwhelming superiority in battleships.

But it may be asked what will be Japan's position six or eight months hence. As she is to-day, so she will be then. Her shipbuilding programme, undertaken at the close of the war with China, has been completed, and she has commenced the construction of no more armored ships. A project has been under discussion for two years, but financial difficulties have interposed to cause its postponement. Time can render this newest member of the concert of the powers no aid, and meantime Russia will be reaping the full advantage of the colossal naval expenditure on which she embarked in 1898.

Should the Russian reinforcements succeed in reaching Port Arthur, she would have at least eleven and possibly thirteen battleships, and five armored cruisers to oppose the six battleships and eight armored cruisers of Japan, and against such odds, unless the Russian personnel is hopelessly incapable, Japan could not fight with any hope of success. The Russian fleet will be far superior numerically at this date to the British Mediterranean squadron in armored ships, though not equal to it in fighting power.

Other powers do not maintain their navies for the express purpose of guarding their interests in the Far East, and it is unlikely that any of them will make any considerable additions to their squadrons in the Pacific in the next few months. Great Britain, it is true, has sent out an additional battleship, the "Centurion," but it is impossible that with the claims on her resources for the defense of the Mediterranean, the English Channel, and the North Sea, she can strengthen her squadron in the Far East much more. There is also little likelihood that either the United States, Germany, or France will materially weaken their position at vital points nearer home to add to the squadrons they now maintain in Chinese waters. It may be taken for granted that six or eight months hence the naval representation of the other great powers will be much the same as to-day. The strength of the several fleets is set out below in summary, the British and Russian reinforcements being included:

	Russia.	Great Britain.	Japan.	U. S.	Germany.	France.
Battleships	13*	5	6	3	..	1
Cruisers—						
Armored	5	2	8	2†	1	2
Protected....	11‡	8	16	4	6	5
Torpedo craft...	40	13	97	..	1	14

* Three of these battleships are temporarily disabled.

†These two ships are coast service monitors.

‡ This is exclusive of the four cruisers sunk; but includes four that are temporarily disabled.

These brief details indicate inadequately the relative strength of the squadrons, but they serve to bring into relief the strong position which Russia will hold should she be able to maintain her position until her fleet has been reinforced. In St. Petersburg it is realized that while in Europe Russia must continue to be at considerable disadvantage, she can dominate Chinese waters with little fear of any other power interfering with her designs. Whatever the outcome of the present war, the eventual result of Russia's action cannot be prevented by the Island Kingdom because it has not the requisite staying and financial power and natural resources which will enable it to continue indefinitely its opposition to Russian designs.

It may be of interest to append a complete list of the fleets of the great powers in the Far East.

GREAT BRITAIN.

Glory, Albion, Ocean, Vengeance — (Admiral Sir Gerard Noel) (Rear Admiral the Hon. A. G. Curzon-Howe) — Sister battleships of 12,950 tons.
Centurion — Battleship, 10,500 tons.
Cressy — Armored cruiser, 12,000 tons.
Leviathan — Armored cruiser, 14,100 tons.
Amphitrite, Argonaut — First class cruiser, 11,000 tons.
Blenheim — First class cruiser, 9,000 tons.
Eclipse, Talbot — Second class cruiser, 5,600 tons.
Sirius — Second class cruiser, 3,600 tons.
Thetis — Second class cruiser, 3,400 tons.
Fearless — Third class cruiser, 1,580 tons.
Phœnix, Algerine, Esplegle — Sloop, 1,050 tons.
Rinaldo, Rosario, Vestal, Mutine — Sloop, 980 tons.
Bramble, Britomart — First class gunboat, 710 tons.
Kinsha — River steamer, 331 tons.
Moorhen, Teal — Second class gunboat, 180 tons.
Robin, Snipe — Second class gunboat, 85 tons.
Sandpiper — River gunboat, 85 tons.
Woodcock, Woo dirk — Second class gunboat, 150 tons.
Six torpedo boat destroyers.

UNITED STATES.

Kentucky — (Rear-Admiral R. D. Evans, commander-in-chief), battleship, 11,540 tons.
Wisconsin — (Rear-Admiral P. H. Cooper, commanding Northern Squadron), battleship, 11,565 tons.
Oregon — Battleship, 10,288 tons.
Monadnock, Monterey — Monitor, 4,005 tons.
Albany, New Orleans — Second class cruiser, 3,769 tons.
Raleigh, Cincinnati — Second class cruiser, 3,213 tons.
Isla de Cuba — Gunboat, 1,125 tons.
Wilmington, Helena — Gunboat, 1,397 tons.
Annapolis, Vicksburg — Gunboat, 1,000 tons.
Don Juan of Austria — Gunboat, 1,130 tons.
Villabos — Gunboat, 347 tons.
Callao — Gunboat, 250 tons.
El Cano — Gunboat, 600 tons.
Alhoy — Gunboat, 51 tons.
Samar — Gunboat, 210 tons.
Frolic — Converted yacht, 607 tons.
Rainbow — (At Cavite, Rear Admiral Yates Stirling), distilling ship.

In addition there are two colliers, the Justin and Pompey; two tugs, the Piacalagua and Wompatuck, and the supply ships Zaffro and Nanshan.

FRANCE.

Redoubtable — Battleship, old, 8,767 tons.
Vauban — Armored cruiser, old, 6,150 tons.
Montcalm — (Vice-Admiral Marechal), armored cruiser, 9,516 tons.
Chateaurenault — First class cruiser, 8,018 tons.
Bugeaud — Second class cruiser, 3,722 tons.
Pascal — Second class cruiser, 3,985 tons.
Styx, Acheron — Armored gunboat, 1,640 tons.
Surprise — Gunboat, 627 tons.
Vigilant — Gunboat, 123 tons.
Decidee — Gunboat, 646 tons.
Argus — Gunboat, 123 tons.
Comete — Gunboat, 473 tons.
Caronade — Gunboat, 140 tons.
Bengali — Dispatch vessel, 547 tons.
Alouette — Dispatch vessel, 506 tons.

GERMANY.

Furst Bismarck — (Rear-Admiral von Prittwitz), armored cruiser, 10,650 tons.
Hansa — (Rear-Admiral Graf Baudissin), second class cruiser, 6,100 tons.
Bertha — Second class cruiser, 6,100 tons.
Thetis — Third class cruiser, 2,645 tons.
Grier — Third class cruiser, 1,776 tons.
Bussard, Seeadler — Third class cruiser, 1,580 tons.

ITALY.

Vettor Pisani — Armored cruiser, 6,500 tons.
Elba — Second class cruiser, 2,730 tons.

SCIENCE NOTES.

A Russian naturalist has made a series of measurements, by a thermo-electric method, of the temperature of insects. A few of his results are noticed below. The temperature of the human body, it will be remembered, is essentially the same in the tropics and in the polar zones. Insects at rest have a temperature essentially the same as that of the surrounding air in ordinary conditions of heat and of humidity. Under usual conditions the temperature of an insect rises with that of the surrounding air, only more slowly. When the air is very moist the insect's temperature may rise more rapidly than that of the air. When the insect begins to move, its temperature rises and continues to rise until the motion ceases. This rise of temperature continues till at about 38 deg. C. (102.2 deg. F.) a heat paralysis sets in. The paralysis is only temporary; it ceases as the temperature falls once more. Below —0.5 deg. C. (31 deg. F.) insects are perfectly without motion. The temperature must, in general, be raised to 12 deg. C. (53.6 deg. F.) before the wings are moved. For one species—*Saturnia pyri*—the highest temperature compatible with life is 115 deg. F. This is about the temperature that is fatal to vegetable life.

For some time past prussic acid has been considered to be the most deadly poison extant. Mr. Lascelles Scott, of Little Ilford, England, however, has now discovered a far more deadly poison—the substance scientifically known as di-methylarsine cyanide, or more familiarly as cyanide of cacodyl. Three grains of this substance diffused in a room full of people would kill all present, so powerful is it. So deadly is this poison, that it is highly dangerous to handle it. It is a white powder melting at 33 deg. and boiling at 140 deg. When exposed to the air it emits a slight vapor, to inhale which is death. Mr. Lascelles Scott has experienced the deadly nature of this poison, for while he was assisting Sir B. W. Richardson in the compilation of his work "On the Causes of the Coagulation of the Blood," he tried its effect upon animals. One-millionth part of cyanide of cacodyl in the atmosphere of an air-tight cage killed a dog almost instantaneously, and then its power was by no means exhausted, for a second, third, and fourth dog placed in the same cage, instantaneously died from the effect of that single infinitesimal dose. Although so little of the properties of this poison are known, it was first made many years ago. Cadet, the famous French chemist, by combining acetate of potassium with white arsenic, produced a fuming liquid which, although he did not know it, was oxide of cacodyl. The German chemist Bunsen combined this with cyanogen, a radical of prussic acid, and made cyanide of cacodyl, the formula of which is $AsMe_2Cy$.

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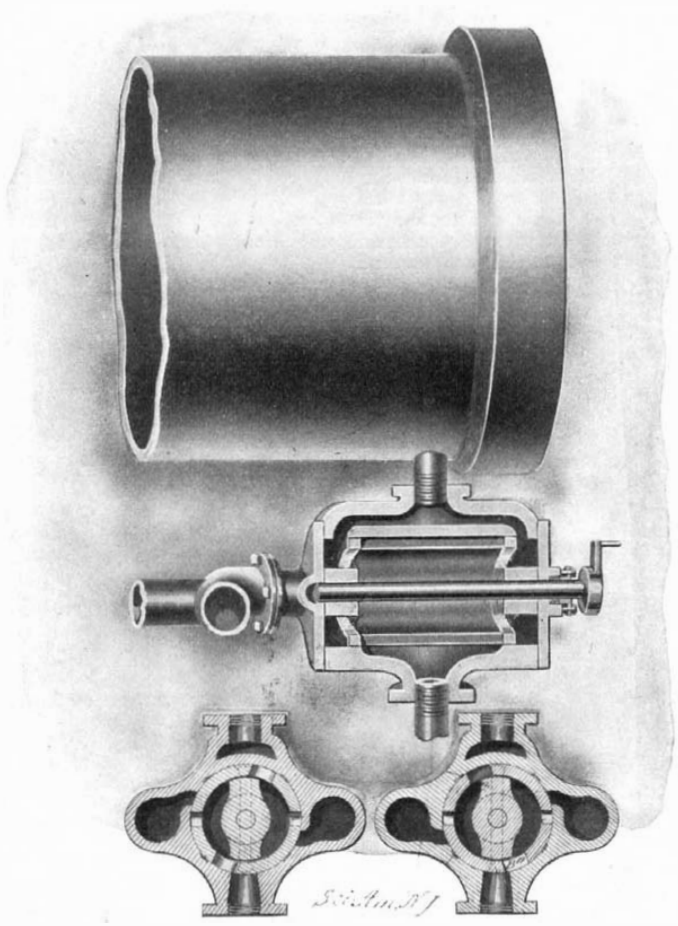
ROTARY VALVE FOR SAWMILLS.

An improved form of rotary valve has recently been invented by Mr. Randolph Gillette, of Little Falls, Minn. This valve is particularly adapted for use on sawmills and embodies means for quickly shutting off the live and exhaust steam at the same time when desired, thus bringing the carriage almost instantly to a stop, and effectually preventing it from running

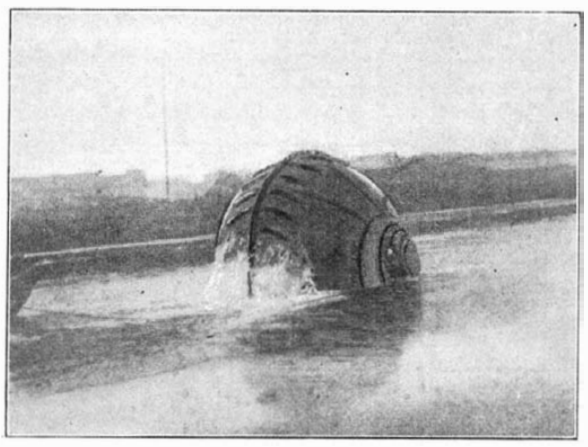


ROTARY VALVE FOR SAWMILLS.

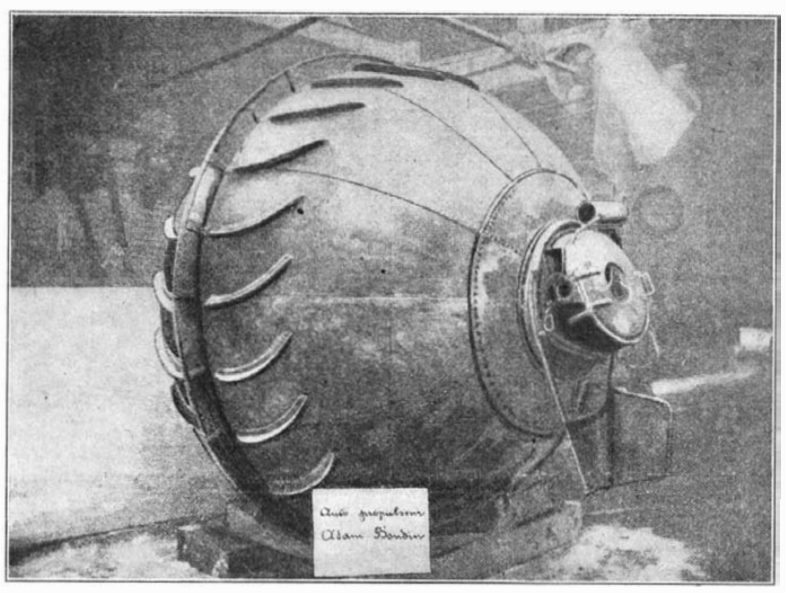
away. Furthermore, the revoluble valve plug is arranged to prevent unequal expansion and contraction, which would distort it and cause it to bind. In our illustration we show one end of a steam cylinder with the rotary valve attached thereto. A similar valve with the exception of a slightly different arrangement of the ports, as shown in the lower left-hand sectional view, is attached to the opposite end of the steam cylinder. These valves are connected to a common live steam pipe and are also controlled by a common lever. As more clearly shown in the section views, the steam is admitted to two ports in each valve casing, one at each side of the revoluble cylinder plug. A shaft passes through the center of the cylinder plug and on this, at each end of the cylinder, a hub is mounted. To allow for contraction and expansion the cylinder plug is not directly connected to these hubs, but is secured by pins to webs formed thereon. The cylinder plug opens at the ends into steam passages which connect with the steam cylinder above. The exhaust port is shown at the bottom of the casing, and may be connected with the steam cylinder through either of two ports oppositely disposed in the cylinder plug. Similarly the live steam ports may be connected with the steam cylinder by bringing into register with them two ports lying between the exhaust ports in the cylinder plug. It will be observed that the valve may be turned to cut off the steam from the steam cylinder, at the same time opening the exhaust port; or, by further turning the valve in the same direction, or by reverse movement of the valve, both the inlet and exhaust ports will be closed. If a workman finds that he cannot stop the steam feed by operating the controlling lever backward, he may drive it forward, and thus stop the feed, or, if the carriage is moving backward, and he cannot cause the lever to move forward, he can drive the lever backward in the same direction and stop the feed.

THE ADAM-BOUDIN GLOBULAR BOAT.

Evidently the roller boat idea is hard to kill. The continental papers have been illustrating what is considered a new type of craft which goes by the name of the "Adam-Boudin self-propeller." The boat, from what we have been able to gather, consists of two concentric spheres, the inner of which, containing a 24-horsepower motor, drives the outer sphere. Vanes are provided on the outer sphere, for the purpose, we presume, of securing some kind of a hold on the water. The motor has four speeds and a reversing gear. The inventor has high hopes for his craft. He confidently assures the representatives of the foreign press that he will be able to make 50 kilometers (31 miles) an hour with his boat. For our illustrations we are indebted to the London Illustrated News.



The Boat Entering the Water.



The Boat on Shore.

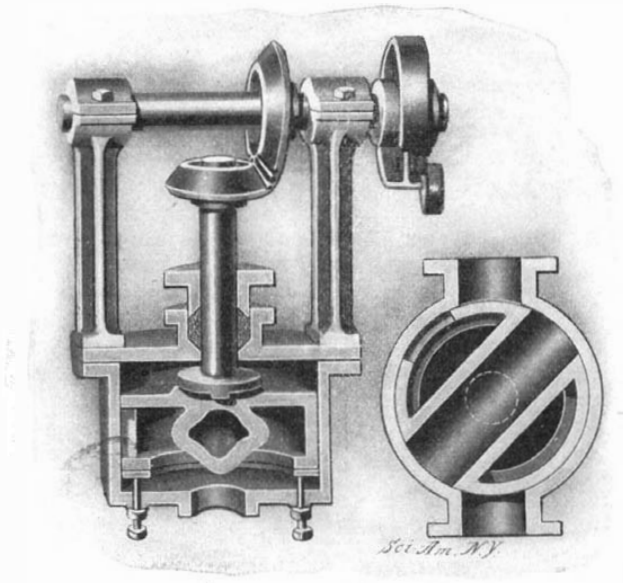
A GLOBULAR VESSEL.

How Baby Bats are Nursed.

"Ever since the days of Pliny," writes Mr. R. Lydekker in Knowledge, "it has been a matter of common knowledge that female bats are in the habit of carrying their helpless young about with them during their aerial flights for some time after birth. With the exception of one peculiar species, the young bat always clings to the under surface of its mother's body, where it obtains a secure hold among the dense coat of fur. The precise position in which the young bat supports itself when its parent is in flight does not appear to be recorded. . . . By the older observers it was generally considered that bats commonly produced two young at a birth, as is testified by Pliny, who wrote that the female carried her twin offspring about with her. Later observations, however, led to the conclusion that this idea was erroneous, and that as a rule only one is produced at a birth. . . . The late Dr. G. E. Dobson, in his time the greatest authority on bats noticed that in certain species of fruit-bats the nipples of the males were much enlarged during the breeding season; and from this circumstance he started an entirely novel idea, which is expressed in the following sentences: 'It is probable that where two young are born at a single birth, the male relieves the female of the charge of one (as the weight of two might render flight difficult or impossible), and at the same time performs the office of a nurse. It is well known that many species of bats have occasionally two young at a birth, but I have never found a mother with more than one clinging to her body. The size of the pectoral teats in many male specimens (though in none yet observed by me so large as in this species and in another case referred to above) led me to think that instances of the male performing the office of nurse are probably not uncommon among bats.' Whether this suggestion is true of fruit-bats must be left for future observation to determine; but it is now practically certain that it will not hold good for the ordinary insectivorous bats; although, so far as I know, no case has hitherto been recorded where a female of any of the European species of bats has been actually seen carrying about her twin offspring. The interest that would attach to a well-authenticated instance of this nature may be commended to the attention of the readers of Knowledge. If, however, instances of female bats carrying more than one baby offspring clinging to their bodies are unknown in Europe, they have recently been brought to light in America. And in these instances not only has the parent bat been seen loaded with the weight of twins, but actually with that of a quartette."

VALVE FOR CONTROL OF HYDRAULIC ELEVATORS.

A patent has recently been granted to Mr. Joseph Utrilla, of 205 Second Street, Jersey City, N. J., for an improved form of valve particularly adapted for use in controlling the motive agent for hydraulic or similar elevators. The valve is very simply constructed and may be readily and quickly operated. A perspective view of the valve in section and the gearing by which it is operated is shown herewith, also a transverse section taken through the center of the valve. By comparing these two views the simple construction will be readily understood. The valve proper consists of a drum with a large opening at the bottom, and a smaller opening at one side. Passing transversely through the drum is a tubular port of oval cross section, which is designed to communicate with inlet and outlet ports in the side walls of the valve casing. The valve proper rests upon a wear ring in the bottom of the casing, and extending upward from the valve through a stuffing box on the top wall of the casing is a valve stem having a segmental bevel pinion on its end engaging with a segmental bevel gear on a shaft supported in bearings attached to the valve casing. Mounted on this shaft is a cable wheel by which the valve is operated. A counter-weight is attached to the cable wheel for automatically moving the valve to closed position upon releasing the cable pressure. In operation, when the valve lies in such position as to bring the tubular port in line with the ports in the valve casing, pressure is admitted to move the elevator upward. By moving the valve through an angle of 45 degrees the tubular port is thrown out of register with the ports in the side walls of the valve casing, as shown in the transverse-section view, and the pressure is thus cut off and the elevator stopped. To cause downward movement of the elevator the valve is turned through a further angle of 45 degrees, bringing the port in the side wall of the valve drum into communication with the outlet port of the valve casing, thus permitting the water or other motive agent to pass back through the outlet port, and thence through the ports in the side wall and the bottom of the valve drum and out through the port in the bottom of the valve casing. It will be noted that the whole movement of the valve is in the space of 90 degrees; therefore, it may be quickly operated in both directions.



VALVE FOR HYDRAULIC ELEVATORS.

The "blue ground" in which diamonds are found at the De Beers and Kimberley mines is called by Dr. Stelzner a "breccia." Most of the angular-edged or rounded fragments of this breccia are composed of a green-black or blue-black serpentine-like mass. Fragments of rock which are found in Karoo formation—such as sandstone, shale, and diabase—are to be found in the "blue ground." There are also other rocks, in the shape of bowlders, which are not known in the Karoo formation, and which doubtless come from a greater depth, possibly from the rocks upon which the Karoo beds lie. The mass of the "blue ground" consists of olivine, more or less changed by oxidation, with the following minerals: Chromic diallage, bronzite, pyrope containing chromium, flesh-colored zircons (locally called Dutch bort), cyanite, biotite, chromite, titanium, magnetic iron, and, finally, small crystals of perofskite.—The Engineering Record.

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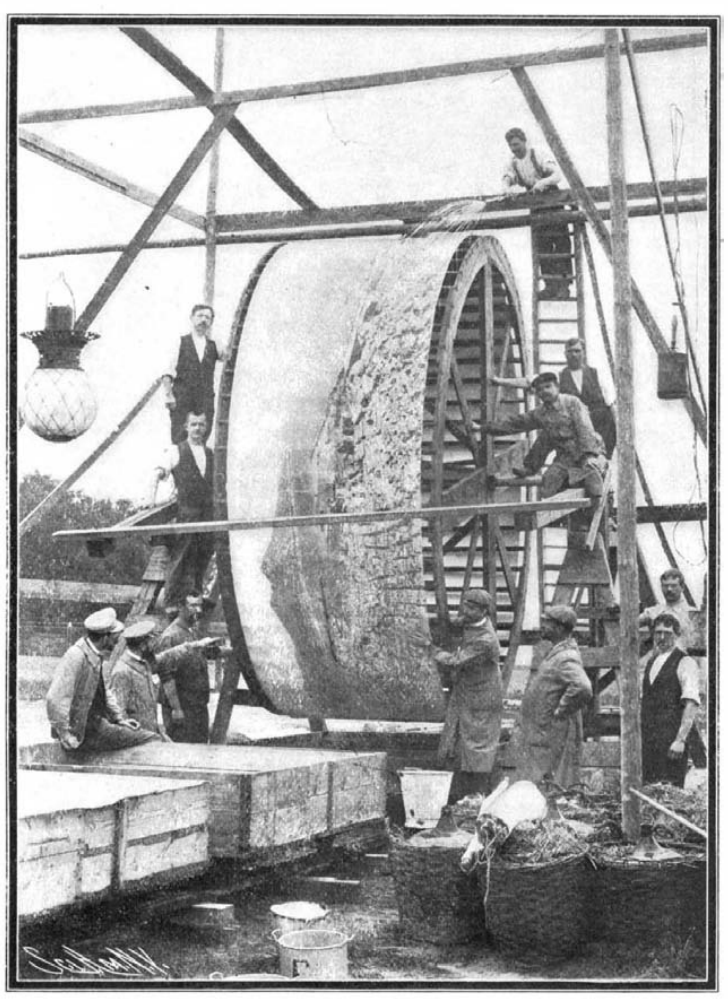
THE LARGEST PHOTOGRAPH IN THE WORLD.

BY OUR BERLIN CORRESPONDENT.

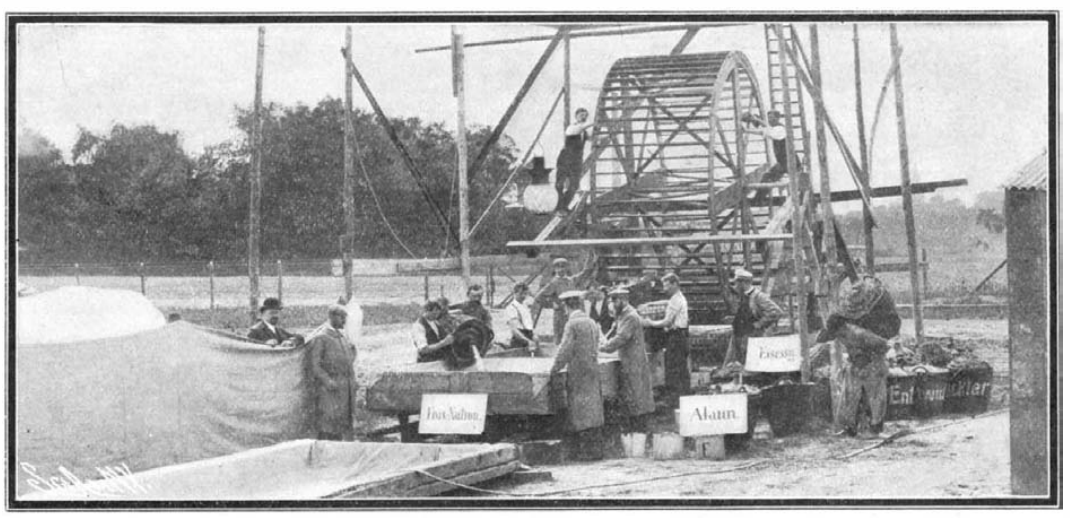
At the recent Dresden Exhibition of German Civic Life, the Neue Photographische Ges. Berlin Steglitz exhibited a photograph which is said to be the largest ever taken. This gigantic picture measures 12 meters by 1½ meters (39 feet 8 inches by 4 feet 11 inches). Another copy of the photograph will be exhibited at the World's Fair by the Rotograph Company, of New York.

The photograph represents the Bay of Naples, and was taken from Castel San Marino, the highest point behind Naples, from which the eye commands the whole city and bay as far as Mount Vesuvius and Capri. In order to secure as extensive a panorama as possible, six different views on as many plates, measuring 21 x 27 centimeters (8.1 inches x 10.5 inches) were first taken. From these six plates, which were designed with a view to being connected to one another in a continuous series, six enlargements, 1½ x 2 meters (4 feet 11 inches by 6 feet 7 inches) in size were prepared by means of an apparatus with a lens 32 centimeters (1 foot) in diameter. The enlargements were made directly on silver bromide paper. The inherent difficulty of connecting the single plates so as to avoid any break was overcome so successfully that it is practically impossible to detect the boundary line of any two plates. According to their character, the six negatives were exposed for unequal periods, varying between ½ and 1¼ hours.

In order to develop the picture, a huge wheel was made of specially prepared wood. The wheel was 4 meters (13.12 feet) in diameter and 1.75 meters (5.5 feet) in breadth, the periphery thus being 12½ meters (41 feet), and containing 90 slats intended for receiving the photographic paper. There were further used three large tanks about 70½ cubic feet in capacity, intended respectively for the developing, clearing, and fixing solutions, acetic acid and sodium hydroxide

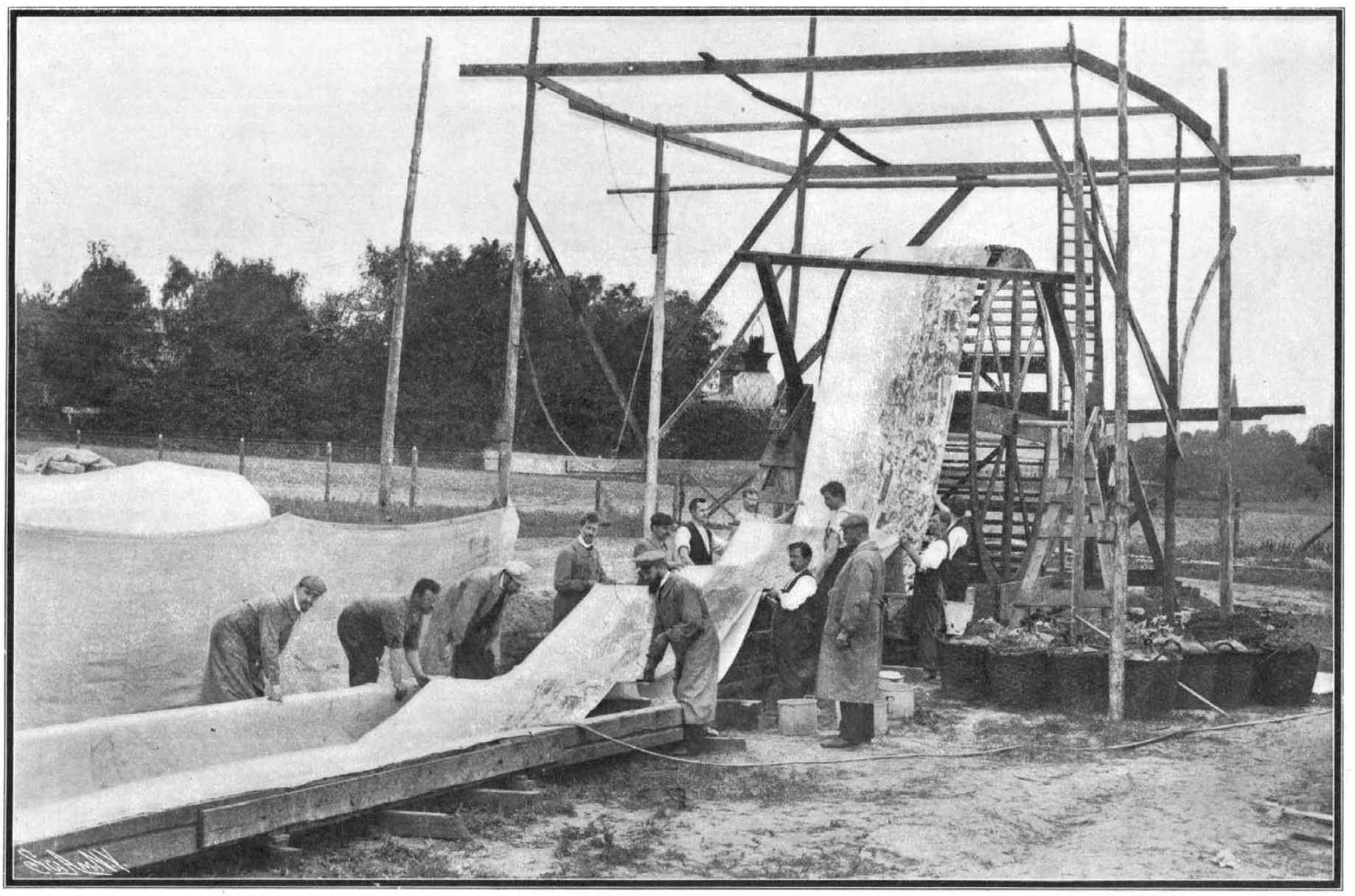


The Photograph During Development.



Preparing the Developing Bath.

Retouching the Finished Photograph.



Unreeling the Print into the Clearing Bath.

MAKING THE LARGEST PHOTOGRAPH IN THE WORLD.

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solutions. Each tank could be shifted about on five iron wheels moving along rails 16 meters (52.48 feet) in length. A gigantic water tank, 15 meters (49.2 feet) in length, 2 meters (6.56 feet) in breadth, and ¾ meter (2.46 feet) in height, having a total capacity as high as 476.68 cubic feet, was further used.

On account of the large developing wheel employed, the paper was developed by night in the open air. Before developing the picture, the exposed paper, fitted with a protecting cover, was laid over the slats of the wheel. The wheel was then set rotating. As it turned, it dipped the lower part of the paper into the developing liquid. The light portions were especially treated with sponges impregnated with energetic developers. Portions whose development was too rapid were checked by means of iced acetic acid solutions. An iron oxalate developer was used.

After first interrupting the developing process by projecting iced acetic acid on the photograph by means of a hand pump, the paper was conveyed into an acetic acid bath, where the clearing process was completed after twenty minutes' time. The picture, after an intense rinsing, was transferred into the fixing bath, where it remained three-quarters of an hour. After another rinsing the photograph was thence conveyed into the large washing tank above mentioned, where it remained for about eight hours, while a continuous supply and withdrawal of water took place. The total consumption of water used in washing the print was about 10,593 cubic feet.

After the water was drawn off, the picture was stretched out on wooden bars attached to the upper edge of the tank, where it remained for about ten hours before it was completely dried.

SAMUEL PIERPONT LANGLEY.

It is safe to say that no just estimate of the very eminent and useful pioneers of the physical sciences for the past several decades would fail to include Samuel Pierpont Langley.

Born in Roxbury, Mass., August 22, 1834, Mr. Langley was graduated from the Boston High School in 1851, thereafter took up the study of civil engineering and architecture, and subsequently practiced these professions, furnishing an instance of a certain tendency among men of attainment to believe in and utilize a minor talent in the beginning as the working field for a career. But his interest in astronomy was innate, and the time saved from the demands of engineering and architecture went to the study of that science. Parts of the years 1864 and 1865 he spent in European travel, visiting foreign observatories and learned institutions, to return bent upon devoting his life to scientific pursuits. The practice of architecture had imbued him with a keen æsthetic sense and powerful constructive imagination. No one better enjoys the beautiful solution of a problem. This fine sense of proportion, but more especially the faculty of creative imagination, modern astronomy and physics both demand as the working basis for success.

In 1865 he became an assistant at the Harvard College Observatory, and the following year was appointed Assistant Professor of Mathematics in the United States Naval Academy at Annapolis. Within the same year he became the director of the new Allegheny Observatory at Pittsburg.

It was here that he found opportunity for one of the few directly utilitarian services ever rendered by astronomy—the establishment in connection with the Pennsylvania Railroad Company's telegraphs, of the now familiar system of the standard time service by telegraphic signals. At that time (1868) the use of local times was universal in this country, even by the railways, and confusion or accident was frequent and inevitable. By these signals this confusion was stopped over the whole area from the Atlantic seaboard to the Great Lakes. The system was at once widely imitated.

Mr. Langley's interest in pure astronomy was now rapidly developing into a greater interest in astrophysics, and he began the well-known series of researches upon the sun and the physics of the solar radiation with which his name has been most intimately associated. In 1869, in 1870, and in 1878 he had charge of government eclipse expeditions, of which the latter, to Pike's Peak, resulted in determining a hitherto unsuspected extent of the corona. His work upon sun spots, extending over this period, is too well known to need mention here, except to call attention to the remarkable accuracy of observation, as well as the skill of draftsmanship, which renders his drawings of sun-spot phenomena made before the days of solar photography, perhaps the final statement of what the eye can see of the surface of the sun.

About 1875 he began to devote much attention to the heat spectra of the sun and other hot bodies, and as an aid to that research he in 1880 devised the bolometer, probably the most useful and delicate instrument for the measurement of radiation.

To this period, and as part of the general research upon the sun's physical relation to the earth, belong the important preliminary papers on the energy spectrum of the sun, the transmission of the earth's atmosphere, on the Solar Constant, the behavior of prisms toward radiations of long wave-length from bodies at low temperatures, the energy-spectra of heated terrestrial objects, and the energy spectrum of the moon. The moon's heat had hitherto been barely recognized by the thermopile, but with the bolometer Mr. Langley was able to analyze minutely the details of its spectrum.

During these researches at Allegheny he had become convinced that there was a great, and then unsuspected, selective absorption of the sun's energy both in the sun's and the earth's atmosphere. Again successful in obtaining the aid of the government, he organized in 1881 an expedition to the top of Mount Whitney, in California, the abrupt heights of that lofty peak permitting observations to be made from two stations geographically close together, but separated by more than two miles of altitude. The result of the observations made became the basis for an entire change in the hitherto accepted value of the Solar Constant, as determined by Pouillet's methods, and the reversal of the old belief that the atmospheric absorption was greatest in the red end of the spectrum.

Mr. Langley was now fairly embarked upon a monumental task, not yet fully completed, requiring unusual niceties of observation and deduction. This was the exploration and mapping of the great unknown region of the solar spectrum lying beyond the visible red light, and in which region fall the wave-lengths of the far greater part of the heat-energy lavished upon the solar system. To the study of the visible spectrum the science of chemistry is under a vast debt, and upon it is largely founded all modern knowledge of stellar systems other than our own. Photography had revealed the invisible region beyond the violet, but wave-lengths of only one-tenth the range he had by 1885 demonstrated to exist were under study by these means.

In 1887, at the beginning of this research, Mr. Langley became secretary of the Smithsonian Institution, which officially represents the interests of the United States in pure science.

It is here that Mr. Langley has most conspicuously shown the characteristics which had early marked him for an eminent career. Without an executive intelligence of a high order, the workings of the institution must have suffered a decline from the high plane of usefulness inaugurated for it by Prof. Joseph Henry, and carried on by Prof. S. F. Baird, whose administration had preceded Mr. Langley's. The institution has expanded in all of its activities under his charge, and his fitness to control a complex system of subordinate bureaus and men has been salient. As the head of the institution, his ability to present to Congress the needs of the sciences in this country has been of great service, and it is due largely to his efforts that the institution also administers private appropriations for scientific purposes, and has attracted large bequests to be devoted to similar ends.

These duties have necessarily occupied much of his time, but he has continued to give his personal direction to the Astrophysical Observatory, which has been most steadily engaged in the investigation of the infra-red spectrum. Here also were carried out a series of comparisons (with the bolometer) of the heat-energy emitted by various natural and artificial sources of light, with that of fire-flies and glow-worms, to demonstrate their relative efficiencies. It was here that, in 1892, the instrumental equipment was brought to include the automatic mechanism whereby the relative movement of the bolometer in the spectrum, and of a photographic plate past the beam of light reflected from the mirror of the galvanometer, were very accurately related, so that the infra-red spectrum could be quickly explored, and a photographic image of its energy-curve recorded. Much valuable minor research in optical physics, as well as in instrumental design, has been here accomplished. Mr. Langley directed a very completely equipped expedition from this observatory to Wadesboro, N. C., for the observation of the eclipse of 1900, which resulted in an interesting determination of a value for the radiation from the corona, and some very remarkable photographic observations.

After Mr. Langley became the head of the Smithsonian Institution, he was enabled to begin that series of efforts to solve one of the greatest of human problems—that of mechanical flight—which has lately attracted such widespread popular interest in this country. His interest in flight dates from boyhood, and it has long been his belief that the true course for the solution of this problem lies initially in the result of a research into the conditions surrounding the behavior of heavy bodies in motion through the air, rather than in immediate experimental attempts at flight. It has been his aim then, in inaugurating any work whatever in this direction, to establish, first of all, with such accuracy as the resources of refined physical measurement and diligent experiment could produce, the conditions which would surround the final mechanical solution. He took up the subject seriously in 1889, and in 1891 published his "Experiments in Aerodynamics"* and later, after unceasing effort he was enabled to print the larger theory in a paper entitled "The Internal Work of the Wind."† This preliminary work satisfied him of the possibilities of mechanical flight, and under the great discouragements of what will perhaps ultimately be recognized as the most difficult branch of mechanical engineering, he commenced and for several years carried on the actual construction of experimental flying machines based upon the principles which had been developed in his private workshop at the Institution. In 1896, for the first time in history, a mechanical structure, free of any attachment to the ground and wholly without any supporting power but its own engines, made several flights of over one-half mile each. Mr. Langley had at this point reached the original aim of his researches in this direction—that of demonstrating, as a question of mechanical engineering, first, the conditions for, and second, the possibility of accomplishing, mechanical flight. It was only later, the necessities of the military branch of the government indicating the need of a demonstration of the practical possibilities of flight, that Mr. Langley determined to go on with those experiments, which are so well known to the newspaper-reading public, and which have so far brought only negative results. It may be said in passing that it requires moral courage of a high order for a man already secure in popular estimation as a savant to attempt to build a flying machine, since the effort is sure of ridicule by a large section of the unthinking public, which sees no merit save in absolute success.

It is difficult to speak of Mr. Langley apart from his work. The two are inseparable. Yet the esthetic sense mentioned as one of his chief characteristics finds outlet in a very wide reading, by no means confined to scientific literature. Added to his capacity to recuperate from the cares of his work by travel, which is perhaps his chief amusement, Mr. Langley is a member of the Metropolitan and Cosmos clubs in Washington, of the Metropolitan and Century clubs in New York, and of the St. Botolph Club in Boston, and may frequently be found at one or the other of their houses, or enjoying the game of golf at some country club.

Foreign institutions and scientific bodies have showered upon him degrees and honors. He has received the degrees, D.C.L., of Oxford; D.Sc., of Cambridge; is a foreign member of the Royal Society of Great Britain, correspondent of the Academy of Sciences, Institute of France, and Fellow of the Royal Astronomical Society, and Member of the Royal Institution; he has been awarded the Janssen medal by the Institute of France, and the medal of the Scientific Society of France, and the Rumford medal by the Royal Society of London; while at home the universities of Harvard, Princeton, Michigan, and Wisconsin have given him the degree of LL.D. He was president of the American Association for the Advancement of Science (1887), and has been awarded the Henry Draper medal and the Rumford medal by the National Academy of Sciences of the United States, of which body he is a member.

Mr. Langley's published writings include over one hundred titles. It is not the least of his important qualifications as an investigator, that he writes with conspicuous clearness and in an English style which enlivens the driest statement.

A 63-Mile Fence.

According to the Kansas City Journal, one of the longest fences in the Northwest is being constructed, running entirely around the Lower Brule Indian Reservation, on the Missouri River, in the central portion of South Dakota. This remarkable fence will be sixty-three miles in length. It is composed of four wires placed on posts set a rod apart, cedar and ash posts alternating. In its construction 250 miles of wire will be used, or 76,000 pounds. To erect the fence required an aggregate of 19,000 posts. In this long fence there will be only three gateways, which will be guarded when the fence is completed.

The fence is being constructed by the Indians themselves under the direction of the agency authorities, the Indians receiving $2.50 per day for man and team and $1.25 per day for men. It is understood that next spring the government will issue stock cattle to the Indians, to be grazed inside this huge inclosure, the purpose of the government being to encourage the Indians in stock-raising so that they can ultimately support themselves.

Andrew H. Bergstrom, of a firm of contractors at St. Louis, has agreed with the Swedish World's Fair commission, to put together their national pavilion free of all cost. The building was erected at Stockholm and has been shipped to St. Louis in sections. Mr. Bergstrom estimates that it will require the services of 150 men three days to put the building together.

* Smithsonian Publication No. 801.
† Smithsonian Publication No. 884.

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Correspondence.

Our Youngest Old Subscriber.

To the Editor of the SCIENTIFIC AMERICAN:

I notice under the head of "Correspondence" in this week's issue of the SCIENTIFIC AMERICAN that A. C. L. takes great credit to himself for having been a reader of the SCIENTIFIC AMERICAN from the time when he was seven years old to the present, when he is thirty-five. The writer of this has been a reader of your paper under the same conditions mentioned in A. C. L.'s article from the time he was six years to the present, when he is forty-three. J. R. F.

Dayton, Ohio, February 20, 1904.

Artificial Cooling and a New System of Heating.

To the Editor of the SCIENTIFIC AMERICAN:

The subject of artificial cooling is one of those that each summer arises anew and figures among the few that are felt as an incongruity in our age of high technical advancement. That an electric desk or ceiling fan does not only not cool the atmosphere of an interior, but helps to heat it through its rapid motion, is well enough known, but strong artificial draft continuously interchanges the hot air, immediately surrounding the human body, for cooler air and accelerates the evaporation taking place, especially on surfaces, thus creating the sensation of cooling with which we satisfy ourselves.

Why are interiors not cooled effectively and in the same way as in heating? Cold, in the shape of ice, is a market article, very common and very cheap, and which is brought daily to everybody's house. A hundred pounds of it cost 20 cents, and with that amount 57,000 cubic feet of air can be cooled from 90 deg. F. down to 70 deg. Such an expense apparently would be no hindrance to the practical introduction and general use of ice for cooling restaurants,, residences, or any other interiors. But what has prevented up to the present time the utilization of ice for that purpose is the lack of the proper means for transferring the cold from the ice to the air. Experiments on a large scale conducted during last summer in cooling a store at 553 River Street, Paterson, N. J., have enabled the writer to convince himself and others of the perfect feasibility of the plan to cool any premises by the use of ice. An apparatus of extreme compactness, consisting of one or more segments, each of which represents an actual cooling (radiating) surface of 275 square feet with but 6 cubic feet of space-displacement, cools the air driven therethrough by a blower, before delivering it to the locality to be cooled; where cold spring water is at disposal this will be sufficient to assure satisfactory results.

Any premises provided with such a cooling plant may with advantage be heated in winter by the very same means, i. e., the same apparatus and the same ducts, adding only a simple hot water heater and omitting the use of a fan. Such a system of heating would then coincide in principle with the well known hot air furnace heating, however, without the latter's drawbacks of possibly overheating the air or deteriorating it in consequence of a leak in the furnace.

Paterson, N. J. G. EPPRECHT.

The Sportsmen's Show.

The annual New York Sportsmen's Show opened in Madison Square Garden on the evening of February 19, and will be kept open till 11 P. M. on that of March 5. The great attraction this year is a large rectangular tank in the center of the garden, moored to the sides of which are the launches and automobile boats of the various exhibitors. No less than five high-speed launches or automobile boats are exhibited, besides an equal number of small launches. Numerous launch motors are also on view. Exhibits of various birds and animals are located on the ground floor, besides a most interesting exhibit of salmon and trout eggs and fry. On the arena platform is a tank of water over which the fly-casting contests are held, while the exhibits of several sporting goods firms are also displayed there in rustic booths. The concert hall contains an exhibit of motor bicycles, one of which, with its motor cut in half longitudinally, is shown operated by an electric motor. An operating sectional model of a two-cycle launch motor is also shown in the main hall.

The armor manufacturers of the United States, in accordance with promise, have added to their facilities, and deliveries amounting to 11,493 tons have been made—a marked increase over any previous year. We learn from the Iron Age that armor plates are now tested with capped projectiles. The acceptance tests for armor-piercing projectiles have been made more rigorous, it being now required that they shall, at a prescribed velocity, perforate unbroken a plate of hard-faced armor equal in thickness to the diameter of the projectile, and then be in a condition for bursting.

THE HEAVENS IN MARCH.

BY HENRY NORRIS RUSSELL, PH.D.

With the departure westward of the bright winter constellations, the skies are becoming duller, especially as there are no conspicuous planets now visible in the evening; but the western half of the visible heavens is still very fine.

At 9 o'clock in the evening in the middle of March, Orion is still in sight, fairly well up in the southeast. The line of his belt is nearly horizontal, and points to Aldebaran on the right and Sirius on the left. The Milky Way, strong with bright groups of stars, lies above these constellations.

Starting almost below the Pole-star, we come first to the zigzag line of Cassiopeia. Next is Perseus, whose configuration is familiar to many who watched the fading of the new star of 1901. Auriga, with the brilliant Capella, follows, and then comes Gemini, whose two brightest stars, Castor and Pollux, lie considerably above the galaxy.

The still brighter star farther south is Procyon, in Canis Minor. South of this is a vacant region, beyond which appear some stars of Argo—a fine constellation, which can only be seen to advantage in the southern hemisphere.

The contrast is great when we turn to the eastern sky. The Dipper in Ursa Major and the Sickle in Leo are the only conspicuous groups near the meridian. Below the latter lies Hydra, a long irregular line of stars extending from a small group east of Procyon clear to the southeastern horizon. The small quadrangle of brightish stars low in the southeast is Corvus, which certainly bears no resemblance to the Raven it is supposed to represent, while Hydra is a pretty fair serpent.

Above this, and south and east of Leo, is Virgo, with one bright star, Spica, and a wide curve of five pretty bright ones between the latter and Leo. Farther north is Bootes, with the brilliant Arcturus, and several second and third magnitude stars. Draco, which is on the right of the pole, and Ursa Minor, inclosed in its coils, are the only other notable constellations in sight.

THE PLANETS.

Mercury is evening star until the 26th, when he passes through superior conjunction—behind the sun—and becomes a morning star. He is invisible to the naked eye throughout the month, as he is very near the sun, and also south of him for most of the time.

Venus is morning star in Capricornus, Aquarius and Pisces. She is much less conspicuous than at the first of the year, being farther south and less than half as bright. However, she is still easily visible before sunrise, as she rises at about 5 A. M. in the middle of the month.

Mars is evening star in Pisces, and can still be seen after sunset rather to the south of west, as he sets more than an hour later than the sun. His brightness is greater than that of the Pole star, and he is much the most conspicuous object in that part of the sky, next to Jupiter, which in the early part of the month is a few degrees below him.

Jupiter is also in Pisces, and is evening star until the 27th, when he is in conjunction with the sun, and becomes a morning star, just as Mercury does a few hours earlier. The two planets are in conjunction about the same time, but they are so near the sun that they are quite invisible.

Saturn is morning star in Capricornus, and is once more fairly visible. At the end of the month he rises about two hours before the sun.

On the night of the 7th he is in conjunction with Venus, which is one-third of a degree to the north of him. The pair of planets should be easily visible in the southeast before sunrise.

Uranus is in Sagittarius, and is in quadrature with the sun on the 20th, coming to the meridian at 6 A. M.

Neptune is evening star in Gemini. He is also in quadrature, on the 23d, but, being east of the sun, is due south at 6 P. M.

THE MOON.

Full moon occurs at 10 P. M. on the 1st, last quarter at 8 P. M. on the 8th, new moon at 1 A. M. on the 17th, first quarter at 4 P. M. on the 24th, and full moon again at 8 A. M. on the 31st. The moon is nearest the earth on the 1st and 29th, and farthest away on the 14th. She is in conjunction with Uranus on the 9th, Saturn on the 13th, Venus on the 14th, Mercury on the 16th, Jupiter on the 17th, Mars on the 18th, and Neptune on the 24th.

At 8 P. M. on the 20th the sun crosses the celestial equator, and enters the sign of Aries, and in the phrase of the almanacs, "Spring begins."

On what is for us the night of March 16, but in Asia daytime on the 17th, there is an annular eclipse of the sun. It is of course invisible in America, but is an important eclipse in Madagascar, India, China, the Philippines, and the Malay Archipelago. The track of central eclipse passes just north of Madagascar, touches the north end of Sumatra, crosses part of Siam, and the extreme northern end of the Philippine group.

The excess of the sun's apparent diameter over the moon's is unusually great, so that the annular phase of the eclipse lasts at maximum for more than eight minutes. An eclipse of the sun is frequently accompanied by one of the moon, a fortnight earlier or later, but this is not the case now, for at the previous full moon the moon passes just south of the edge of the earth's shadow, and at the subsequent one just north of it. At the time of the present solar eclipse, however, the moon is almost exactly between the earth and sun, so that her shadow falls on the earth's equatorial regions. If she was farther north, so that her shadow fell in the Arctic regions, she would be farther south at the ensuing full moon, and would enter the earth's shadow and be eclipsed (partially at least). In general, we may expect that a solar eclipse which is central in the equatorial regions will not be accompanied by a lunar eclipse, while if one is visible near one of the poles, there will be a lunar eclipse at the preceding or following full moon (which one depends on whether the moon is moving north or south at the time).

An exceptionally good chance of observing an occultation of a star by the moon is afforded on the evening of March 22, when the bright star Aldebaran is occulted. As seen from Washington, the star disappears behind the moon's dark limb at 8 o'clock, and reappears on the other side at six minutes past 9. The exact times of the immersion and emersion will be different at each place of observation.

As the moon is in her first quarter, her dark limb will be sufficiently illuminated by the "earth-shine" to make it visible, and one will have fair warning of the star's disappearance. The disappearance of such a bright star can be observed even with the naked eye, but a field-glass is a valuable aid, and a telescope still better. The reappearance is much harder to observe, for unless one knows just where the star will reappear, it is hard to pick it up when it first comes out.

The most striking feature of the star's disappearance is its absolute suddenness. It vanishes instantly. As is well known, this is the strongest proof that the moon has practically no atmosphere, for the refraction of an atmosphere would delay the star's disappearance, and make it gradual. Such gradual disappearances of a star's light have been observed, but many cases have later been explained by the discovery that the occulted star was double.

Cambridge University, England.

The British International Cup Race for Motor Boats.

The Automobile Club of Great Britain and Ireland has extended the time for receiving entries for the international cup race to June 30, 1904, and the Automobile Club of America will receive entries up to June 1. If the entries are so numerous as to make it necessary to hold eliminating trials, in order to determine which three boats shall represent America, these trials will be held shortly after the latter date. The race will take place in the Solent on July 30.

This race is to be held annually for a trophy presented by Mr. Alfred Harmsworth. Not more than three competing boats can represent each country, and each competing boat must be constructed wholly, in every particular, in the country which it represents. The boat must not be longer than 40 feet over all, but there is no restriction as to the number, size, or horse power of its motors. These must be sufficiently powerful to drive the boat astern at four knots an hour in still water, and to drive it over the entire course at an average speed of at least 12 knots. The course must be in sheltered waters of the country holding the cup, and it must be from 6 to 12 nautical miles in length.

In addition to the two Napier boats entered in the English eliminating trials, J. E. Hutton, Ltd., has entered three 40-foot racers fitted with six-cylinder motors having a bore and stroke of 6.889 and 6.299 inches respectively and said to develop 170 brake horse power at 1,200 revolutions per minute. The total weight of the motor is 1,500 pounds. The Messrs. Thornycroft and Lord Howard de Walden have also entered boats in these trials.

France will also be represented by a strong team. Among the entries already made in that country are A. Clement's and Pitre & Co.'s gasoline boats, and a Gardner-Serpollet steam launch. It is hoped that Germany and America will also be well represented.

The estimated capacity of the new blast furnace plants to be started in the United States in 1904 is about 2,000,000 tons, and of this quantity it is computed that 905,000 tons will be for sale in the general market, which may mean increased competition in Europe. A further increase of capacity, equaling 2,425,000 tons, is credited to the year 1904, of which 405,000 tons will be thrown on the general market, so that a total of 1,310,000 tons is likely to be thus dealt with.

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THE MODERN TORPEDO.

Commenting during the late Spanish war upon the efficiency of the torpedo, we said: "Although torpedo warfare has not as yet achieved results at all proportionate to the amount of thought and skill that have been devoted to it, the failure has probably been due more to a lack of opportunity or of efficient handling than to any deficiency in the torpedo itself." The startling events that marked the opening of the Russo-Japan war have established the truth of that statement, for in the hands of an alert, intelligent, and daring people, this deadly weapon, in the first half hour of hostilities, sank two of the finest battleships and one of the best cruisers of the Russian navy, and incidentally struck a blow at the naval prestige of Russia from which that country will take many years to recover. At the same time, the Port Arthur torpedo attack must be judged at its true value; and, therefore, we must not lose sight of the fact that information is finding its way to the public ear which makes it pretty evident that the Russian ships were not looking for, and were totally unprepared to receive, a torpedo attack. If this is the case, what has been proved is that if the torpedo boat can get unmolested within easy range, the torpedo is fairly sure of its mark—and this we all knew well enough before the war began.

The Whitehead torpedo is undergoing constant development, the latest improvement being the introduction of the gyroscope for the purpose of keeping the torpedo more accurately upon its true course. The latest patterns include this device and are generally of larger diameter and greater length than the earlier types. We show illustrations of a Schwartzkopff torpedo, which is the type used in the Russian navy. It is merely a modification of the Whitehead and operates upon the same principles. In a later issue we shall illustrate the latest type of Whitehead as used in the Japanese navy, and illustrate in detail the operation of the Obrey gyroscope.

The torpedo here shown consists of a cigar-shaped body of phosphor-bronze or steel, divided into six separate compartments as follows: 1, the magazine; 2, the secret chamber; 3, the reservoir; 4, the engine compartment; 5, the buoyancy compartment; 6, the bevel-gear chamber.

The magazine contains the explosive charge, which consists of a series of disks of wet guncotton packed snugly together. The cartridge primer, *k*, for exploding the charge, consists of several cylinders of dry guncotton packed in a tube which passes through perforations in the guncotton disks, *t*. The foremost of the six cylinders contains a detonating primer consisting of fulminate of mercury. The small propeller at the extreme point of the torpedo is part of an ingenious safety device for preventing premature explosion in handling. When not in use, the firing pin is held in check by a sleeve; but as soon as the torpedo strikes the water, the rotation of the little propellers releases the sleeve and leaves the firing pin ready to strike the detonating primer the moment the torpedo meets an obstruction.

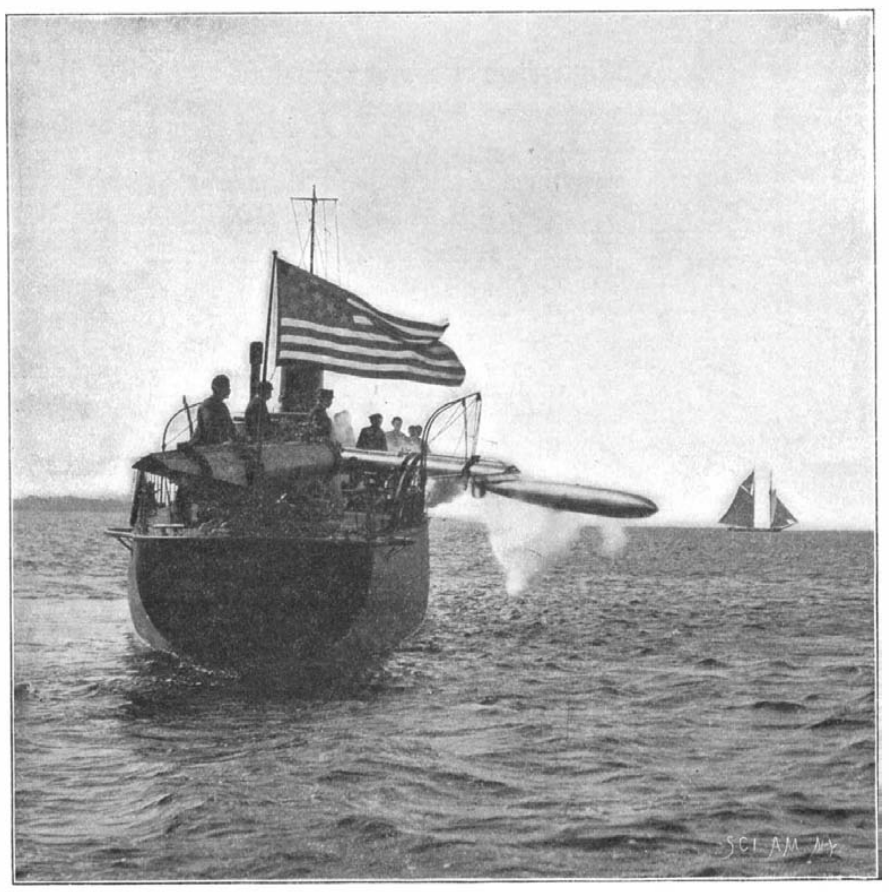
The "secret chamber" is the most ingenious part of this most ingenious piece of mechanism. Its piston, pendulum, and springs perform the important work of regulating the horizontal rudders which keep the torpedo at the proper depth. Immediately in front of the secret chamber is a narrow compartment perforated on its walls to allow the outside water to enter. The front wall of the secret chamber carries a piston, *a*, which can move in the direction of the axis of the torpedo. The pressure of the water is resisted by three coiled springs, as shown in the longitudinal section. At a certain predetermined depth, according to the tension on the springs, the springs and water pressure will be in equilibrium; below that depth the piston will be driven in by the water pressure, and above it the springs will push forward the piston. To prevent too sudden oscillation in this action, the piston is connected to the rod, *e*, of a swinging pendulum, *d*. The motion of the piston is communicated by rods, which pass through the hollow stay rods of the air chamber to the horizontal or diving rudders. If the torpedo goes too deep, the piston moves back, the pendulum swings forward, and the rudders are elevated, the reverse movements taking place if the immersion is not sufficient. When a torpedo dives into the water, the first part of its run is made on a wave line which crosses and recrosses the desired and ultimate level of immersion, the piston and the pendulum gradually bringing the torpedo to a true course. The reservoir forms the central body of the "fish." It is made of forged cast steel and is tested up to seventy atmospheres. A tuyere at its after end feeds the air to the engine. The torpedo is driven by a three-cylinder engine, with cylinders 120 deg. apart, acting on a common crank. The engine is started by means of a valve which is opened by a lever striking a projecting lug on the launching tube, when the torpedo is fired.

The buoyancy chamber is an air-tight compartment, the purpose of which is to afford the proper buoyancy to the torpedo; it carries a piece of lead ballast, by shifting which the trim can be controlled. The two tubes, *f* and *g*, carry the connecting rods for controlling the horizontal diving rudders.

Next comes the bevel gear chamber, where is located the gear, *l*, for causing the propellers, *m*, to rotate in opposite directions. The after propeller is keyed to the main shaft; the forward propeller is keyed to a sleeve which rotates freely upon the main shaft, and the motion is reversed by means of two bevel-wheel gears which turn on a spindle at right angles to the main shaft. The "tail" consists of a stock with vertical vanes, which act as the vertical rudder, and two frames which carry the horizontal rudders.

The torpedo is fired from a launching tube by the explosion of a small charge of gunpowder behind it. This compresses the air which surrounds the rear half of the torpedo and thrusts it out of the tube without any serious jar.

The range and speed of the torpedoes vary with the size. The weapon here shown is 14 inches in diameter, 15 feet in length, carries 90 pounds of guncotton, and has a speed of 28 knots for a range of 800 yards. The 18-inch Whitehead torpedo is 16 feet 7½ inches in length, carries a charge of 220 pounds of guncotton, and has a speed of 31 knots for 1,000 yards.



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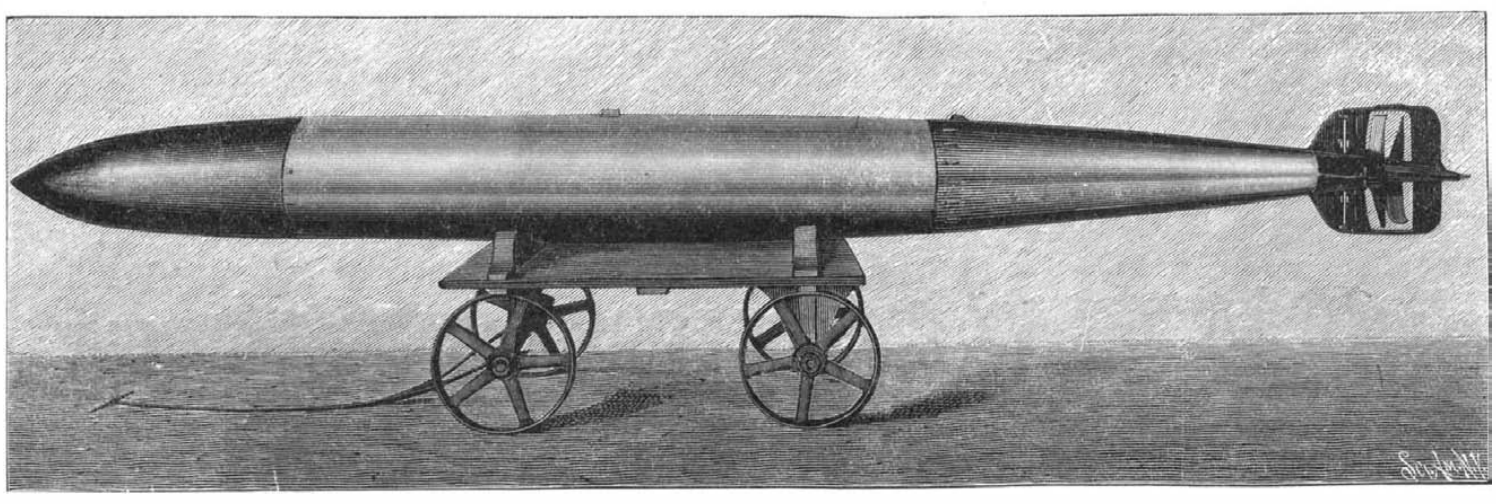
TORPEDO PRACTICE AT NEWPORT, R. I.—LAUNCHING A WHITEHEAD TORPEDO FROM THE TORPEDO-BOAT "MORRIS."

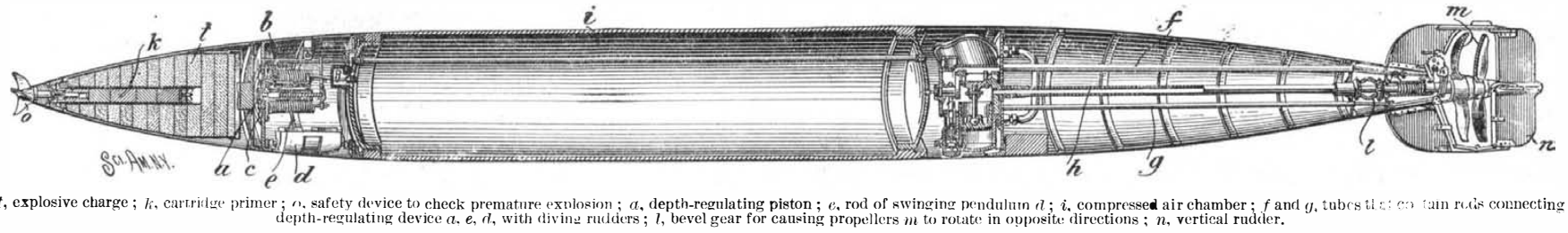
The Destructive Action of Radium on Fabrics.

In a recent number of Nature Mr. Blythswood states that he happened to replace the usual mica plates used in connection with the ordinary ebonite box with a piece of cambric, so as to permit the whole of the emanations to pass out, the mica stopping the alpha rays. In four days the cambric was rotted away. Mr. Blythswood states that he has renewed the cambric several times with the same result.



SIDE VIEW OF A 14-INCH TORPEDO.

The United States Navy Bureau of Steam Engineering is about to place an order for nickel steel boiler tubes and condenser tubes, to be installed on one of the vessels plying in home waters, so that the tests which will be made can be under constant supervision. A careful comparison will be made of this material and the simple steel tubes now in use.



t, explosive charge; *k*, cartridge primer; *b*, safety device to check premature explosion; *a*, depth-regulating piston; *e*, rod of swinging pendulum *d*; *i*, compressed air chamber; *f* and *g*, tubes that contain rods connecting depth-regulating device *a*, *e*, *d*, with diving rudders; *l*, bevel gear for causing propellers *m* to rotate in opposite directions; *n*, vertical rudder.

LONGITUDINAL SECTION THROUGH A SCHWARTZKOPFF TORPEDO, A TYPE USED IN THE RUSSIAN NAVY.

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JUPITER AND HIS SURFACE CURRENTS.

BY THE REV. T. E. R. PHILLIPS, M.A., F.R.A.S.

The general aspect in the telescope of the planet Jupiter is well known. His markedly elliptical disk, which is distinctly brighter in the center and gradually fades off toward the limb, is traversed by a series of dusky belts which vary from time to time both in width and position. These belts frequently show great irregularities at the edges, being broken up or indented by a number of light and dark spots, while dusky wisps are often to be seen projecting from them across the bright zones which separate them. The accompanying drawings will serve to illustrate the general arrangement of the surface features and also the great and rapid changes of aspect to which they are subject. Thus it will be seen from the illustrations that in the years 1896 and 1898 (Figs. 1 and 3)—as was also the case in 1901 and 1903—the belt lying north of the equator was quite narrow, but that at other times it was broad, and exhibited numerous condensations and white spots at its edges. It not infrequently happens that the general aspect of the planet undergoes a marked alteration even in the course of a single apparition. Thus Fig. 6 represents a view of Jupiter in June, 1902, but by the latter part of the autumn the appearance of the disk had materially changed. The equatorial regions were intensely white—a very striking contrast to the rich, warm, coppery tone which was so marked a feature of the planet a few years ago—and the whole of the disk north of the N. temperate belt was deeply shaded with a delicate bluish gray.

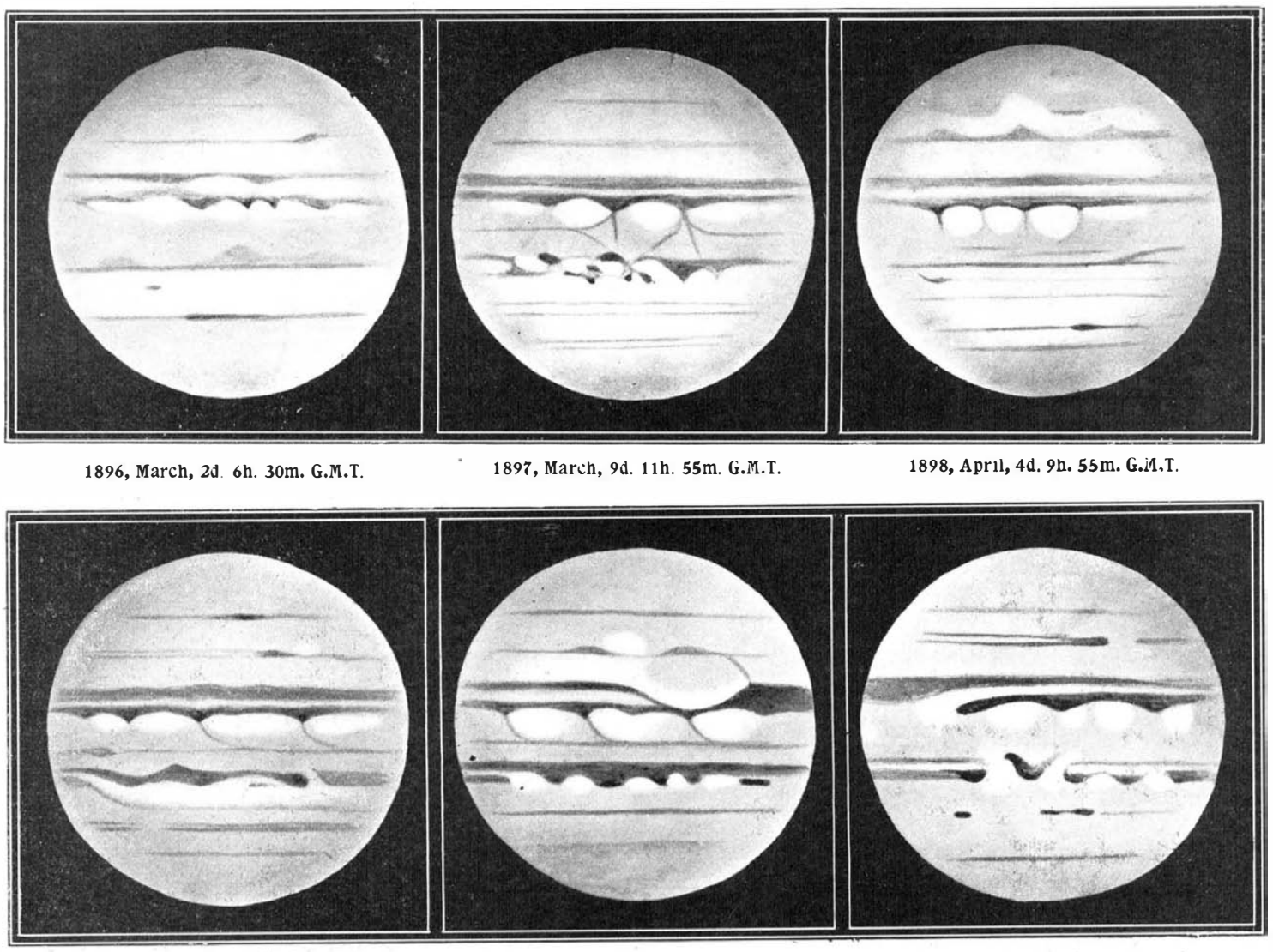
It is probable that some of the changes on Jupiter are of a cyclical or seasonal character. Mr. A. Stanley Williams in a valuable paper communicated to the Royal Astronomical Society in April, 1899, showed from a discussion of a large number of observations extending over many years that there is a remarkable variation in the color of the two principal equatorial belts. Thus, when the S. equatorial belt is at a maximum of redness, the N. equatorial belt is at a minimum, or even bluish in tone, and *vice versa*. The mean period of these variations is found to be about twelve years, and as this corresponds with the length of a sidereal revolution of Jupiter round the sun, it is probable that the change observed is of a seasonal character. The maximum redness occurs soon after the vernal equinox of the particular hemisphere in which the belt exhibiting it is situated. In accordance with the interesting conclusion at which Mr. Williams has arrived, the N. equatorial belt has lately been intensely red, and the S. equatorial belt almost colorless, except in the region immediately following the Red Spot bay.

But, perhaps, the most interesting and instructive feature hitherto observed in connection with Jupiter is the difference of speed with which his spots and other markings are drifting. So long ago as the latter part of the seventeenth century, Cassini found that the markings in the neighborhood of the equator performed a rotation in nearly six minutes less time than was required by objects further north and south. Sir William Herschel, Schröter, and other observers confirmed this result, but as the outcome of the labors of more modern investigators, a considerable number of distinct currents are now known to control the movements of Jupiter's surface material. There can be no doubt that many recorded changes on Jupiter are in reality due to the great proper motions of the objects observed, which quickly cause them to become relatively displaced.

With one or two exceptions these surface currents are pretty constant. Their velocity varies within certain limits, and the latitude of their boundaries is not always the same, but whenever definite spots or observable condensations appear their movements of rotation are nearly always found to conform more or less closely to the normal speed of that latitude.

But interesting as is the investigation of these surface currents, the real nature of Jupiter's physical condition is the problem which students of the planet must endeavor to solve. It has generally been agreed that the belts and spots of Jupiter are of the nature of clouds and atmospheric vapors; that the true globe of the planet has never been seen; and that its real rotation period is consequently unknown. But whatever view may be adopted as to the vaporous character or otherwise of the visible features of the disk, it is probable that the internal body of the planet rotates in a period somewhat longer than any markings we can observe—possibly in a period just a minute or so less than 10 hours. As regards the relative altitudes of the various markings, there seems good reason to suppose that the more swiftly moving objects are situated at a greater height than those which move more slowly. Of course, it must be remembered that the planet may have no solid or definite surface divided off from the vapors which form its belts and spots. It is highly probable—bearing in mind the very low density of Jupiter—that the whole globe is still in an intensely heated, semi-molten, and viscous condition, and that what we see is but the outermost shell of visible material. Prof. Hough, in his important and valuable paper already referred to, suggests that the visible boundary of Jupiter has a density of about one-half that of water, is of the nature of a liquid, and that in it are immersed the Red Spot and others whose motion in longitude and latitude are slow and gradual, and which are tolerably permanent or long enduring. He considers that the equatorial and other belts may be at the surface of this liquid or at a higher level than the Red Spot, and that the equatorial regions may be concealed by overlying vapors at a much greater altitude, in which openings and irregular condensations give rise to the appearance of white and dark spots.

No doubt there are many interesting questions in connection with Jupiter of which the solution must be left for future students; but this much, at any rate, we may suggest with some confidence: We look at Mars and our own satellite; in them we see a forecast of physical conditions to which some day the earth must at least approximately attain. We look at Jupiter, and, in the constant agitation of his heated globe, we catch a glimpse, though on a giant scale, of our own world in the dim recesses of the past.—Abstracted from Knowledge.



1896, March, 2d. 6h. 30m. G.M.T. 1897, March, 9d. 11h. 55m. G.M.T. 1898, April, 4d. 9h. 55m. G.M.T.

1899, April, 15d. 12h. 10m. G.M.T. 1900, April, 20d. 14h. 15m. G.M.T. 1902, June, 26d. 14h. 31m. G.M.T.

CHANGES IN THE ASPECT OF THE PLANET JUPITER OBSERVED AT VARIOUS TIMES.

The Chord Galvanometer and the Human Electrocardiogram.

In the Archives Néerlandaises, W. Einthoven has indicated the principle of a novel galvanometer, made up of a silvered quartz thread, stretched like a chord in a strong magnetic field. As soon as an electric current was led through the thread, the latter will diverge at right angles to the direction of the magnetic flux, the amount of deflection being directly measured by means of a microscope with an eyepiece micrometer. Some important improvements of the instrument have been made, enabling the chord (a quartz thread 2.4 millimeters in thickness and 10,000 ohms in resistance) to be stretched strongly. Under certain circumstances, currents not higher than 10^{-12} amperes may be detected by the instrument. The chord may be stretched sufficiently to have a current of a given strength produce a predetermined deflection. The image of the middle of the chord, after being magnified 660 times, is thrown on a split perpendicular to the image of the chord. In front of the split there is a cylindric lens, the axis of which is parallel to the split, while behind a photographic plate is moved in the direction of the image of the chord. At the same time, a system of co-ordinates is projected on the sensitive plate according to Garten's method, where the horizontal lines are obtained by a glass millimeter scale, placed immediately in front of the sensitive plate, so that the sharp shadows of the division are projected on the plate, whereas the vertical lines are due to the spokes of a disk rotating uniformly intercepting intermittently the light falling on the split. From the photographic diagrams thus obtained it is inferred that the deflections, being aperiodical, are exactly proportional to the intensities of the current. This instrument is applied by the author to determining the human *electrocardiogram* discovered by A. D. Waller (Philoso. Transactions, vol. 180, 1899, B, p. 169). It is interesting to note the constancy in the form of this curve for a given person, the alterations occurring in the course of time being so small as to allow with little practice to recognize many persons by their electrocardiograms.

Russia and Korea's Non-Participation in the St. Louis Fair.

The American Ambassador at St. Petersburg has cabled to the State Department at Washington that the Russian government has notified him of its intention to withdraw from participation in the St. Louis Fair.

A similar notice of withdrawal has been sent by Korea.

To prevent further disasters, such as that which visited Galveston, Tex., in 1900, when 3,000 houses were destroyed and 8,000 lives were lost in the floods, it is proposed to raise the whole of the city. According to the present plan, earth is to be brought from along the coasts of the Gulf and banked upon the site of the city, so that it shall be at level of from 17 feet to 20 feet above the sea.

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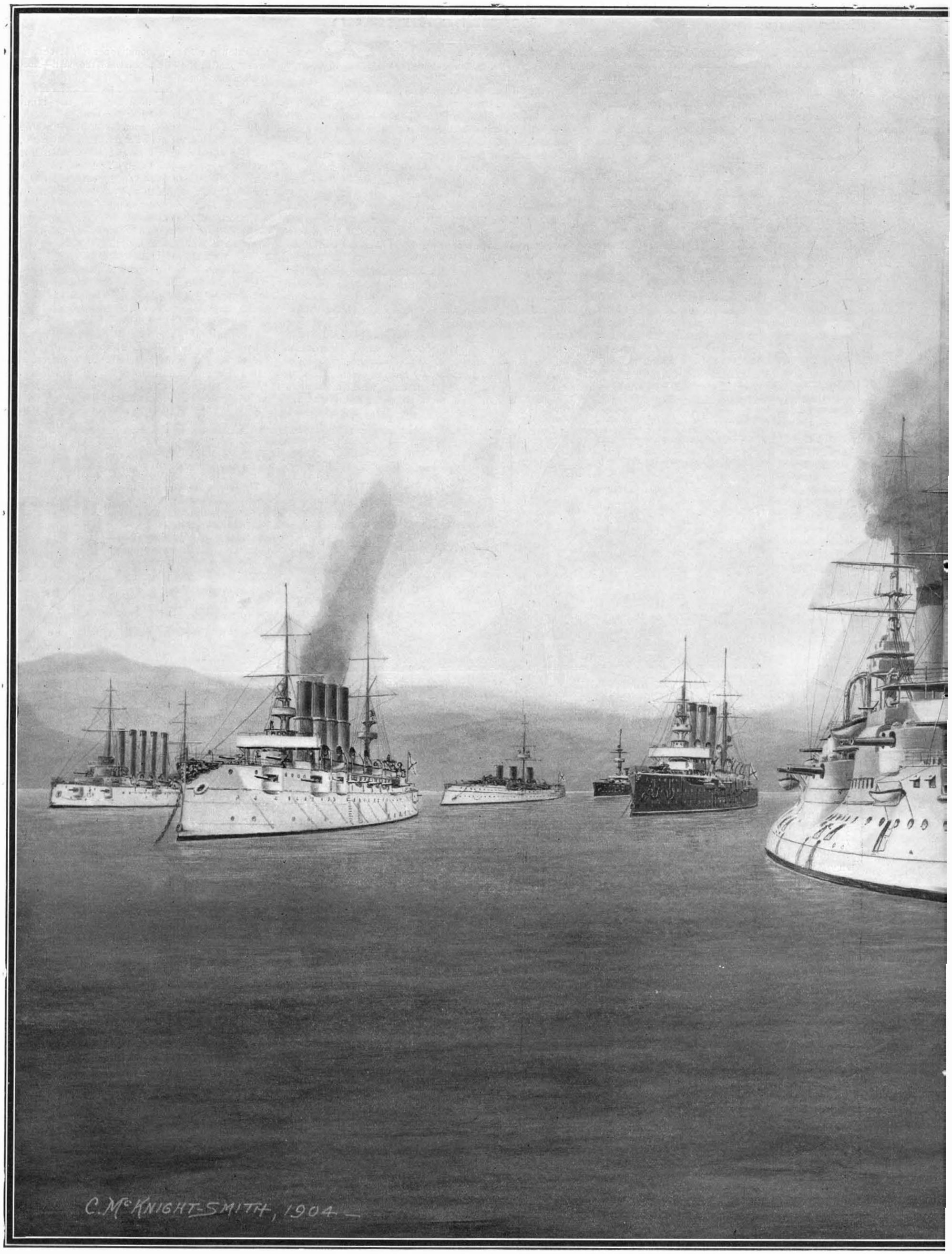

Protected Cruiser "Askold."
6,500 tons. 23 knots.
Hole below waterline.

Protected Cruiser "Variag."
6,500 tons. 24.6 knots.
Sunk by gun fire.

Protected Cruiser "Novik."
3,000 tons. 26 knots.
Hole below waterline.

Protected Cruiser "Pallada."
6,630 tons. 20 knots.
Sunk by torpedo.

Gunboat "Korietz."
1,500 tons. 11 knots.
Sunk by gun fire.

Battleship "
13,000 tons.
Sunk by t

RUSSIAN BATTLESHIPS AND CRUISERS DISABLED OR

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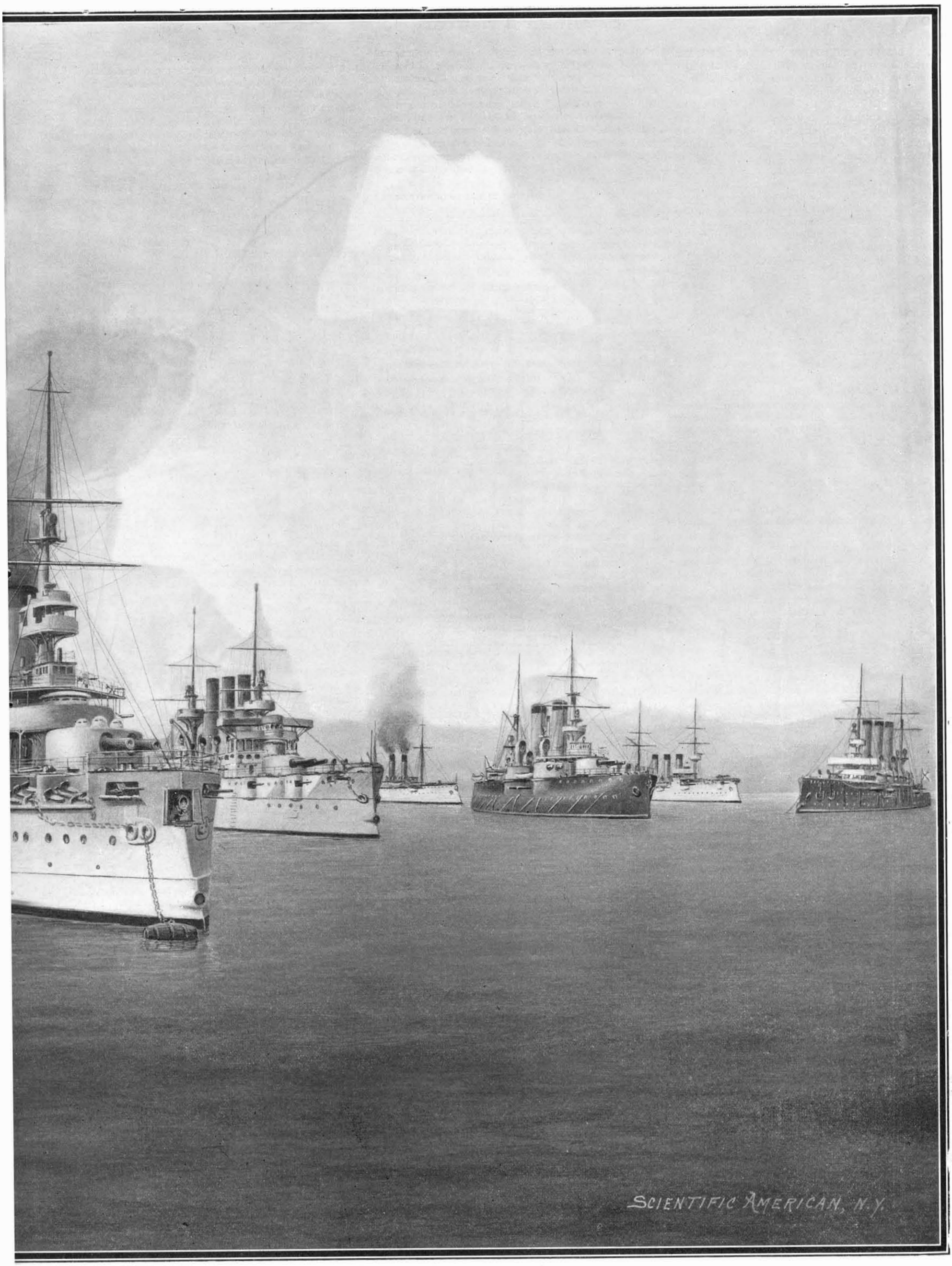

zarevitch."
18 knots.
orpedo.

Battleship "Retvizan."
12,700 tons. 18.6 knots.
Sunk by torpedo.

Torpedo Transport "Yenesei."
2,500 tons. 18 knots.
Sunk by mine.

Battleship "Poltava."
11,000 tons. 17 knots.
Hole below waterline.

Protected Cruiser "Boyarin."
3,200 tons. 22.5 knots.
Sunk by mine.

Protected Cruiser "Diana."
6,630 tons. 20 knots.
Hole below waterline.

[See page 200.]

SUNK BY THE JAPANESE IN THE FIRST WEEK OF THE WAR.

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RUSSIA'S LOSSES IN THE FIRST WEEK OF THE WAR.

There has been no war of modern times in which there was such a dearth of reliable information as in the present struggle between Russia and Japan. If we carefully sift out all the sensational reports with which the papers have been flooded, we find that the only really reliable information is contained in the brief but expressive official reports sent by Admiral Alexieff, the Russian Viceroy in the Far East, to the Czar. These, supplemented by a few authentic accounts by eye-witnesses and some meager information from the Japanese government, enable us to tabulate the number of Russian ships that have been disabled, but without being able to state, except in two cases, what is the nature and extent of their injuries.

It has been proved in the case of ships of our own navy that it takes but a mere touch of a reef of sand or rock to send a ship to the drydock for several months at a stretch; yet, speaking broadly, it may be said that injuries from striking a reef are relatively mild compared with the blowing in of a large section of the ship's side or bottom, which must result from the explosion of a modern Whitehead torpedo carrying over 200 pounds of guncotton. Consequently, it may be safely assumed that the Russian ships which have been disabled by torpedoes are put out of action, at least for several weeks, probably for several months, and quite possibly, for good. Of the eleven Russian vessels already disabled in the war, we know that three, the battleships "Czarevitch," of 13,000 tons, and "Retvizan," of 12,700 tons, and the cruiser "Pallada," of 6,630 tons, were disabled by the torpedo during the first attack on Port Arthur. We think it is unlikely that either of the two battleships can be made available for active service except, perhaps, in a more or less crippled condition, during the present war, and this for the following reasons: The draft of these vessels at normal displacement is 26 feet, and since they were probably in war trim, with a full complement of sea stores and coal aboard, the draft may easily have been 28 feet. The crushing in of the bottom or side by the torpedo must have resulted in the flooding of at least one compartment, if not two, which would easily add another three feet or more to the draft, especially if the vessels had taken on a heavy list, throwing one bilge deeper in the water. Now, the Port Arthur dock is supposed to be only about 450 feet in length, and it is quite possible that it has only a draft of 28 feet over the sill, in which case the disabled battleships would be unable to enter, unless the bottom could be temporarily patched up and made sufficiently air-tight to permit of pumping out the damaged compartments. This presumption is borne out by a recent report supposed to emanate from Port Arthur, to the effect that these two ships are to be employed as guard ships at Port Arthur, until some opportunity occurs to send them for repairs to the big drydock at Vladivostok. The cruiser "Pallada," of 6,630 tons, whose draft is only 21 feet, will probably take her turn in drydock, that is if she is still afloat. In addition to these three vessels, that are known to be seriously crippled, two others, the protected cruiser "Boyarin," of 3,200 tons, and the torpedo transport "Yenesei," of 2,500 tons, have been "hoist with their own petard," by coming in contact with submarine mines that had been laid for the protection of Port Arthur harbor. These two vessels may be stricken off the list for good. Two other ships, the cruiser "Variag," of 6,500 tons, and the gunboat "Korietz," of 1,500 tons, were sunk by gun fire at the battle of Chemulpho. If they are floated it will be by the Japanese salvage ships, and they will become an asset of their navy. The battleship "Poltova," of 11,000 tons, and the cruisers "Pallada," "Askold," and "Diana," vessels of about 6,500 tons and 23 knots speed, are reported as having been disabled by a "hole beneath the waterline," the same description being used of the injury to the 3,000-ton protected cruised "Novik." It is puzzling to determine just what this injury amounts to, or by what agency it was inflicted. If the ships were penetrated by gun fire, the holes would scarcely be below the waterline, unless the vessel happened to be rolling her under-body out of the water at the time the shell struck. It is, of course, possible that the hole was made by some solid projectile that struck the ship with a plunging effect, hitting her just at the waterline on the side that was exposed to fire, and passing out below the waterline on the other side. If the injury were not caused by a shell, it must have been the work of the torpedo, in which case these vessels must be included in the terrible list of fatalities wrought by the Japanese destroyers. There is presumptive evidence that the cruisers were injured by gun fire, in the fact that the "Novik" is reported as having left the dock after repairs were made, for it is certain that no injury wrought by a torpedo could be made good in so short a time.

After one has taken the most optimistic view possible of the present condition of the Russian fleet, the fact remains that in the very first week of the war, a fleet of eleven vessels, all but one of which were of the most modern and approved construction, and several of which were among the very best of their class, were temporarily or permanently disabled, and four at least of them completely lost to the Russian navy. If one wishes to obtain a vivid idea of the enormous damage entailed in this one week of the war, he has but to look at our double-page illustration, showing this fleet of eleven ships assembled in one group, and then turn to the accompanying table, showing the size and cost of each vessel. Here we have eleven ships of a total tonnage of 73,160 tons, and a total cost of about $35,000,000, put out of action at a cost in torpedoes, powder, and shell to the Japanese of far less than the cost of the "Korietz," the smallest vessel in the disabled fleet.

RUSSIAN SHIPS LOST OR DISABLED IN FIRST FEW DAYS OF THE WAR.

Name.	Date.	Tons.	Cost.	Nature of Damage.
Czarevitch	1901	13,000	$6,900,000	Torpedoed.
Retvizan	1900	12,700	6,500,000	Torpedoed.
Poltova	1894	11,000	5,500,000	Hole below waterline.
Pallada	1899	6,630	3,000,000	Torpedoed.
Askold	1900	6,500	3,000,000	Hulled at waterline.
Diana	1899	6,630	3,000,000	Hulled at waterline.
Variag	1899	6,500	3,000,000	Sunk by gun fire.
Boyarin	1900	3,200	1,400,000	Blown up by mine.
Novik	1900	3,000	1,300,000	Hulled at waterline.
Korietz	1886	1,500	450,000	Sunk by gun fire.
Yenesei	1900	2,500	800,000	Blown up by mine.
Tonnage and value of ships destroyed or disabled	.....	73,160	$34,850,000	

Such is modern naval warfare. It was believed that it would be swift, sudden, disastrous, and costly. The first seven days of this, the first struggle between two navies that were both well equipped and thoroughly up-to-date, has proved that modern naval warfare is even more terrific than was foretold.

Melting Out Frozen Water Pipes Electrically.

During the recent intense weather the method of thawing out frozen water pipes electrically was undertaken successfully at Altoona, Pa. Mr. E. B. Greene, the well-known superintendent of the Edison Electric Illuminating Company of that city. He now writes to the Electrical World and Engineer as follows concerning practical results:

We use for this purpose alternating current of low voltage, the maximum voltage not being over 50. The method of doing this, as you know, originated with Messrs. Jackson and Wood about the year 1900, so you will appreciate that it is not new with us. We use a 25-kilowatt transformer wound for 50 volts, using an amperemeter to know what quantity of current we are using, and reduce the voltage with a water rheostat, using common table salt to impart the necessary conductivity.

The transformer, water rheostat, and instruments are assembled in a box which is hauled out to the place desired to use, when the transformer is connected up to run as in ordinary methods of lighting, using the water rheostat on the primary side of the transformer (as this requires a very much smaller vessel for the water rheostat). The secondary, or low-voltage cables, are connected directly to the spigot or to the pipe inside the building, the other one being connected to a fire plug, or, if more convenient, to the pipe in the adjoining house, which then completes the circuit on the iron pipe for the low potential.

We have thawed 250 feet of one-inch pipe in twenty minutes actual time of current on, using between 18 and 20 kilowatts. In smaller services, say ¾ inch, and on 30 or 40 feet, we have thawed out in from five to eight minutes, using about 11 to 15 kilowatts. The apparatus is very small and it is quite a convenience to people to have water, when their pipes are frozen, in two or three hours after asking to have the apparatus connected up. There is, of course, very little business in the sale of current in connection with the above, but the advertisement we get from being able to help out people who don't have water we think will repay us amply for the trouble and the expense entailed.

As you, no doubt, can see from the above the cost of sending out the transformer, the time of the men connecting up and disconnecting, and the draying charges would leave very small margin unless you would charge an excessive price, which we don't believe it pays us to do. The cost varies very much. The cheapest job, which was near by the station, was $2.50; the most expensive one was $9.50; yet the amount of current used is a very small amount as compared with the charges for labor and drayage.

Electrical Notes.

The news comes from Paris that the operation of extracting radium from the ores has been considerably shortened. The preliminary process, which reduces the material to laboratory dimensions, now occupies one month, whereas it has previously taken three months. It is estimated that up to the present about 730 tons of ore have been used to produce about one-fifth of an ounce of radium.

Advices from Canada state that the Canadian government is looking into the subject of the electrical smelting of iron, and is sending a commissioner to Europe to study the subject. Canada has many valuable iron ore deposits in the vicinity of large water powers which could be utilized for generating a cheap supply of electrical energy.

What is known as the inverted arc lamp, and which has been used for illumination in some workshops for many years, is suggested for the artificial lighting of lawn tennis courts on dull days and at evening time. An installation of these lamps has recently been put up at the tennis courts at Sheen, near Richmond, and was brought into use recently at a special tournament arranged to test the capabilities of the light. Four lamps of 1,500 candle power each are arranged around the court, an even illumination being obtained with the aid of screen sheets, from which the light is reflected. The experiment is said to have been a success, the illumination obtained being only slightly inferior to daylight on bright days.—Electrical Eng. (London).

It has been frequently found by experimenters that when an oxide of a metal, whose temperatures of reduction and volatilization are nearly the same, is mixed with sufficient carbon to combine with the oxygen, and heated to the temperature of reduction, the main resulting product is not the metal which is wanted, but a carbide. The reason is thought to be that the metal becomes volatile as soon as it is formed and combines with free carbon present in the mixture. In a patent granted to Mr. F. J. Tone, engineer of the Carborundum Company, of Niagara Falls, and described in the Electrical World, these disadvantages are overcome by maintaining proper conditions of temperature, proper distribution of heat, and proper arrangements of the charge. The method may be described by its application to the production of silicon for a mixture of silica and carbon. The constituents are finally subdivided and thoroughly mixed, and the design of the furnace is such that the discharge of heat is over a wide zone (as opposed to localized heat), so that the progress of the reaction is relatively slow and the best conditions are maintained for agglomerating the particles. The most even temperature possible is maintained throughout the zone of reaction, to prevent the silicon from being volatilized as soon as formed, and the charge is so arranged in the furnace as to allow globules of reduced silicon to drop by gravity out of the zone of reaction to a lower portion of the furnace. It is evident that for these purposes an arc furnace would be unsuitable. Mr. Tone therefore employs a resistance furnace. The heating resistance in the center of the furnace is made up of carbon blocks piled together with intervening spaces. The charge is fed into the furnace at the top, and as the silicon is reduced it sinks down into the cooler portion of the furnace, and finally into the receptacles at the bottom, where it solidifies as a metallic block.

The Current Supplement.

The opening article of the current Supplement, No. 1470, deals with the whale-oil industry of the United States. It is copiously illustrated. Various types of rails used in Europe and in America are described in an exhaustive article. Dugald C. Jackson's paper on the typical college course dealing with the professional and theoretical phases of electrical engineering is published in full. Foreign and American types of horizontal boring machines electrically operated are described by F. C. Perkins. Dr. Samuel G. Tracy writes instructively on thorium and its therapeutical possibilities. Kretschmer's tetrahedral design for boats is described in full. "Tobogganing in a Basket" is the title of an entertaining article by Laura B. Starr. The usual notes will be found in the Supplement.

The Depth of the Antarctic Ocean.

The State Department has received from John Barrett, United States Minister to the Argentine Republic, a communication to the effect that the Scotia scientific expedition, sent to the Antarctic from Scotland to make meteorological and oceanographical observations, cruised about five thousand miles to the south and east of the South Orkney Islands, between longitude 16 degrees west and 45 degrees west and as far south as 70 degrees 25 minutes, and in this region located a deep sea of an almost uniform depth of 2,500 fathoms. The deepest sounding was 2,739 fathoms, or 16,434 feet.

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THE "SCOOTER."

That "necessity is the mother of invention" finds singular and forcible illustration in the ice-scooter, which, essentially a Long Island creation, is almost as necessary there in the winter as are the yachts in the summer season. It is an amphibious craft, combining in its construction a modification of both the yacht and ice boat, the advantages of each of which it possesses in a remarkable degree.

Reference to the illustrations will show both the sail arrangement and runners on the bottom. It is to these latter, perhaps, that the speed and steady flight of the ice-scooter is due, as well as to the absence of a rudder, which would necessarily arrest the free motion. The jib is utilized for a rudder, serving the double purpose of directing the course and tacking. Steel runners are said to be preferable to those of brass, through their superior hardness, which prevents any sliding when a tack is being made. Such an amphibious boat will lay within five points of the wind, and can execute, in less time and space, any evolution which an ice boat or yacht can perform. Incredible speed is attained by the larger and more completely equipped scooters, and when their respective courses run parallel, they can often maintain their lead over a fast express train. While a boy can manage one of these strange craft, the requirements and possibilities are such as to afford exhilarating sport for a strong man in handling the sails and obtaining the maximum degree of speed possible under given conditions.

The sail area is always determined by the capacity for carrying canvas on the ice. When the water is reached there is consequently, under normal wind conditions, a dangerous excess of sail, and the utmost skill is required to avert an accident. Such is the proficiency attained by the votaries of "scootering," however, that injury to the owners or scooters is rarely if ever witnessed.

There are, perhaps, few more interesting sights seen than those afforded by a scooter plunging at full speed from the ice into the water. At such times the water, cleaved as by a shot hurled from a cannon, is thrown into the air a distance of twenty feet, completely enshrouding the scooter from view until, with speed little diminished, it glides smoothly and triumphantly out upon the ice at the other side of the opening.

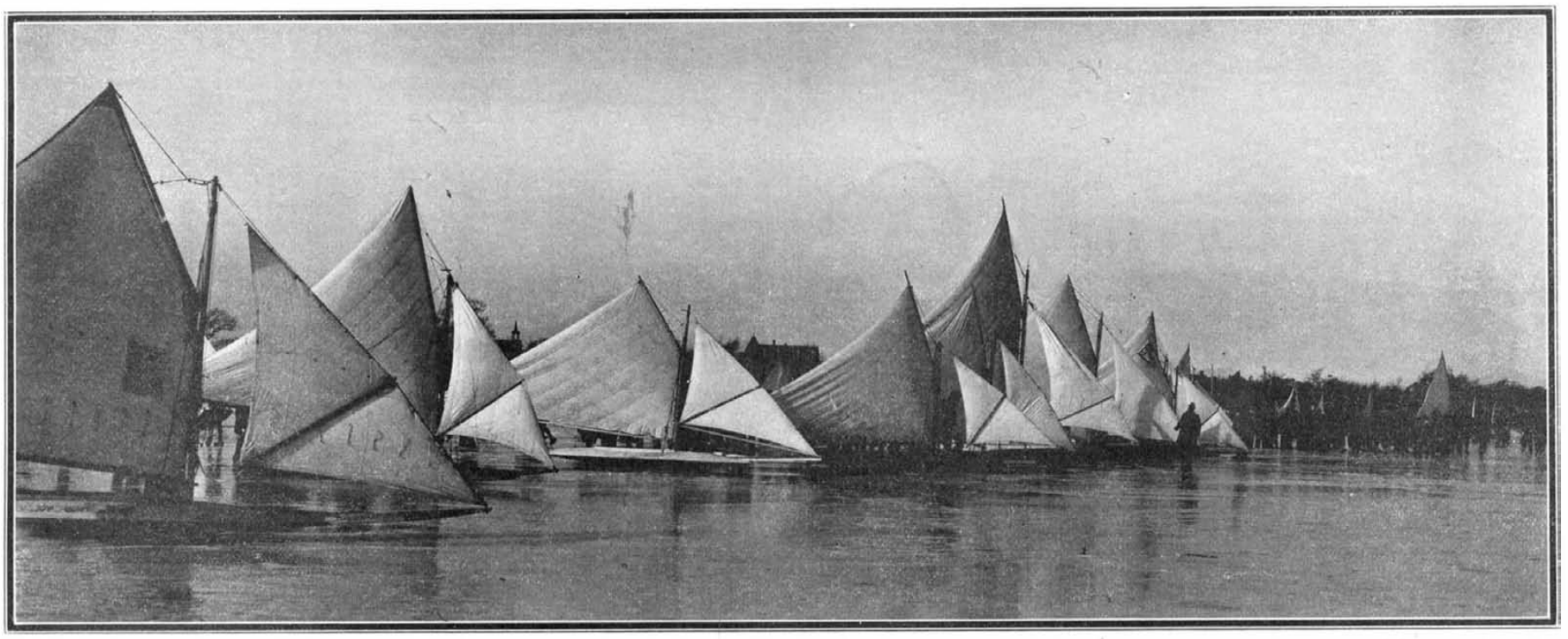
SQUARE-END SCOW FITTED UP AS A "SCOOTER."

While "scootering" provides a healthy and hearten-ing sport for the South Beach life savers during their long period of enforced leisure, its value consists chiefly in permitting them to cross to their mainland homes over thin and treacherous ice when no other means would permit of such visits. It also affords an easy and speedy access to vessels caught in the ice when intervening open-water patches or unsafe ice would render the tendering of assistance impossible.

Long Island sportsmen have also adopted the craft, and successfully employ it in carrying them to favorite duck and goose hunting grounds on the ice, miles away from the shore. When the point for shooting operations is reached, the sail can be furled and the mast removed. Then, by covering the scooter with cakes of ice or snow, it provides an ideal concealed shelter from which to shoot birds.

The scooter has been suggested as a more sure, safe, and speedy method of reaching the North Pole than any hitherto devised. It can be carried on the vessel as far as open water will admit, and, after it has been loaded with provisions, the journey can be continued with it, as neither ice nor water presents any obstacles to its progress. While, like the summer yacht, these boats may be built with any degree of elaborateness, those used on Long Island are made with a view to speed and lightness rather than to other objects.

One of our illustrations also shows a square-end scow fitted up as a scooter. This boat is a home-made affair, and, to be properly steered, requires the use of a rudder. The rudder, it will be observed, consists of a metal blade secured to a pole in such a manner that when in water it can be used as an oar blade, and when out of the water its edge will cut into the ice, thus affording a suitable means for steering the boat.



FLEET OF "SCOOTERS" AT GREAT SOUTH BAY, LONG ISLAND.

OVERTURNED "SCOOTER," SHOWING THE STEEL RUNNERS ON THE BOTTOM.

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RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC SWITCH.—W. K. DODGE, Manhattan, Kan. The invention is in the nature of a switch so constructed and arranged that two or more lights or sets of lights or any combination of the same may be thrown into circuit and the circuits which are "on" are plainly indicated from the exterior of the case. It consists in the novel construction and arrangement of the switch and in the combination with the same of an indicator which plainly shows what circuits are turned on even in the dark.

Engineering Improvements.

STEAM-BOILER.—N. L. WARREN, Macon, Ga. An object in this case is to provide a boiler of large heating capacity, but requiring comparatively little floor-space and so arranged that it may be readily inspected and cleaned both within and without. Space between the tubes will permit a person to inspect flues and other parts of the interior, and the boiler is provided with a manhole, normally closed by a cover.

TRACK-SANDER FOR LOCOMOTIVES.—G. M. SCHWEND, Birmingham, Ala. The intention in this improvement is to utilize water as a medium for effecting the discharge of sand from the reservoir or sand-box usually arranged upon the boiler of the locomotive, the same being delivered upon the rails in front of or behind the driving-wheels for understood purposes. The apparatus is specially adapted for using sand in any condition—that is, wet or dry sand—as it may be had from banks thereof at any point along the track.

LOCOMOTIVE-VALVE.—H. G. CORYELL and J. E. STEPHENS, Marietta, Ga. The present invention has for its object the provision of a valve designed to be operated from the outer side of the locomotive and by means of which the steam may be quickly cut off from either one of the steam-chests should accident or breakage occur in one of the chests, thus permitting the locomotive to be at once worked from the opposite or intact steam-chest.

Miscellaneous.

PIPE.—E. SEMPLE, Seattle, Wash. The improvement is particularly in pipes for use in carrying sand, gravel, and other material from dredges, hydraulics, or other excavating devices, the pipe being particularly designed for use as a dredger delivery-pipe. Pipes used for carrying the above named material are rapidly worn out by the grinding of the same as it passes through. The wooden lining of blocks on end, with the hoops to hold the blocks in place, is designed for the lining of any pipe, the object being to increase the life of pipes where the wear is great enough to wear them out in a few months.

COLLAR OR CUFF HOLDER.—E. L. PITTS, Jerome, Arizona Ter. This device holds cuffs and holds collars in place when in use. In use the device may be buttoned by a divided button to the neckband, or to the wristband, and a socketed head be forced through the buttonhole of the collar or cuff, as the case may be, and a hinged section be then adjusted over the collar or cuff and a spring-catch be forced into the socketed head to secure the collar or cuff as desired.

VALVE.—N. OBOLENSKU, Hermitage, N. Y. The object of this case is to provide a valve, arranged to allow of regulating the speed of the water or other fluid passing through the valve to prevent leakage and to give convenient access to the parts for repairs and for quick replacement of worn-out parts and for other purposes. The invention refers to check-valves, such as shown and described in Letters Patent formerly granted to this inventor.

DRAWERS-SUPPORTER.—H. W. POST, New York, N. Y. The purpose in this instance is to provide a form of supporter adapted for attachment at the inner portion of the waistband of the trousers, the supporter constructed, preferably, of one piece of wire of suitable gage or a strip of metal of any cross-sectional shape, the supporter comprising two loops rigidly held apart and means whereby the device may be secured to the inner face of the waistband or between the layers forming the same projecting upward at the inner face of the trousers-waistband.

FIRE-EXTINGUISHER.—F. YOST, Weehawken Heights, N. J. Mr. Yost's invention pertains particularly to improvements in portable hand-operated extinguishers of the class designed to contain an extinguishing chemical solution, an object being to provide clamping devices of novel form and operation for tightly holding the pump mechanism in place; and another object is to provide a piston-rod with a large air capacity, the confined air acting as a piston.

DEVICE FOR STRETCHING AND PRESSING TROUSERS.—F. STEVENS, Syracuse, N. Y. The aim in view in this case is the provision of a durable article adapted for the purpose of stretching trousers to take out the "bagging" in the knees thereof or for pressing the trousers, to the end that the wrinkles and bagging may be removed and made to present a neat appearance.

HOISTING AND CARRYING DEVICE.—M. C. WOOD, Rockhill, S. C. The particular application of this invention is to a hoisting device for lifting the cylinders of cotton-seed linters from their bearings and conveying the cylinders to a desired point. The principal object is to provide a device for hoisting the dulled cylinder from its bearings and removing the same to a suitable point, after which a sharpened cylinder may be conveyed by the hoisting mechanism to the linter and substituted for the previous cylinder.

TILE.—S. B. FLINT, New York, N. Y. The tiles are of such construction that they may be assembled by hooking together, to the end that each tile assists in holding a series of other tiles in place, and in a manner to prevent separation, notwithstanding that they are subjected to strain in any direction. The tile has considerable strength owing to the disposition of the recesses and the construction of the hooking projections. Their corresponding shape and size enable them to be assembled easily and quickly for covering a surface of any size.

TWINE-HOLDER.—R. A. STEEB, Roselle, N. J. The object of the invention is to provide a twine-holder, more especially designed for household use in conveniently storing odd pieces of twine, cord, string, thread, and the like, such as are received from stores, etc., arranged to permit of winding up in a spool and tied together to allow ready use of the continuous twine thus formed for tying packages, bundles, boxes, etc. The holder may also be used for holding a ball of twine, etc., if not too large for the device, one end of the spool being removable permitting the ball to be placed on the spool.

FLY-CATCHER.—J. ZIERL, Hechingen, Germany. In this patent the invention is embodied in a body or bar provided at the top with a receiver or holder for the tacky substance and at the lower end with a reservoir for the flies, also with detachable end portions which are adapted to receive the tacky substance and to be interchanged when the lower one becomes full.

MUSICAL INSTRUMENT.—E. S. STEVENSON, Eldorado, Kan. The purpose in this case is to provide an instrument having the general characteristics of a guitar—that is, as to its strings and notes, with an auxiliary set of strings and frets with stops by means of which a large number of notes and variations of scales may be quickly made with a small number of the auxiliary strings.

MEANS FOR ATTACHING STIRRUP-LEATHERS TO RIDING-SADDLES.—J. MARTIN, Chalet Elizabeth, Avenue des Casernes, Grasse, France. The aim of the present invention is to construct a support for stirrup-leathers in which when the rider falls from his horse and his foot remains in the stirrup the stirrup-leather becomes detached from the saddle by the weight of the rider. When in the saddle the rider may bear upon the stirrups without fear.

HORSE-COLLAR.—J. V. STONE, Moorhead, Minn. This invention has reference to improvements in horse-collars, and the object is to construct a collar having a stuffed body and pneumatic pad which will serve to protect the horse's shoulder. Should the bag collapse, the driver need not unhitch, since the stuffing forms a body of the usual shape, and a horse could pull as well with both bags collapsed as with an ordinary hard collar.

DESIGN FOR A COVER-DISH.—R. L. JOHNSON, Hanley, Stafford, England. The plan of the cover-dish shows a symmetrical oval shape. The outline of the side presentation is beautifully curved from the handle of the cover down to the flanged base. The handles at the ends are very gracefully fashioned. The ornamental decorations are richly spread around and near the edge of the cover, the upper part of the body, and the base.

AUTOMATIC OR SELF-ACTING GATE.—J. DELAUNAY and R. VASQUEZ, Buenos Ayres, Argentina. The gate may be opened from either side by pulling a cord and in every case the gate opens away from the passer. The opening is effected by moving to one side or the other the upper end of the rod or axle on which the gate is hinged, whereupon the gate under action of gravity swings open in the direction in which its axis has been inclined.

RECEIVER FOR MAIL, ETC.—N. D. CLEARWATER, Binghamton, N. Y. The device consists of a box hinged to the jam of an outer door of a residence. The box is open only at one side through which packages may be placed in or removed from the box. When a package is placed in the box, the box may be swung on its hinges until the open side lies against the door of the house. In this position it is held by a spring latch which can be released only through the open side of the box. The contents of the box are thus rendered secure against theft, for they cannot be removed except by opening the door of the house.

CLOTHES-DRIER.—F. S. MACDOUGALL, of Seattle, Washington. This clothes drier comprises a number of clothes-suspension arms pivoted to a rotatable carrier which is mounted on a leaf hinged to a back-board. When in use the leaf is swung to a horizontal position at right angles to the back-board and is held by a latch. Means are provided for holding the rotatable carrier in any desired position.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

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The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 5191.—For machinery for making tins.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 5192.—For machinery for mechanical workshop, such as carpenters' utensils for iron and brass foundry, metallic roofs, filtration systems, pipes, cranes, rails, trucks, cars, etc., also all materials, implements and accessories connected with this industry.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 5193.—For makers of ice-harvesting machines, for cutting and for filling houses.

WANTED.—An up-to-date superintendent for our plant employing 250 men; foundry, machine shop and wood shop. Also foreman for machine shop, and foreman for wood shop. DeLoach Mill Manufacturing Company, Atlanta, Ga.

Inquiry No. 5194.—For makers of lathe machinery for making all kinds of turnings, such as druggists' cases, etc.

Wanted—Revolutionary Documents, Autograph Letters, Journals, Prints, Washington Portraits, Early American Illustrated Magazines, Early Patents signed by Presidents of the United States. Valentine's Manuals of the early 40's. Correspondence solicited. Address C. A. M., Box 773, New York.

Inquiry No. 5195.—For makers of ice-making machinery, such as plants of from four to ten ton capacity.

Inquiry No. 5196.—For manufacturers of molding machines for molding wax cakes.

Inquiry No. 5197.—For manufacturers of light roller bearings, suitable for grindstone shafts and pedal shafts.

Inquiry No. 5198.—For machinery for erecting a plant for manufacturing telescope mailing tubes.

Inquiry No. 5199.—For makers of pulley blocks for clotheslines. also for makers of clothes dryers, such as used in kitchen.

Inquiry No. 5200.—For the address of the manufacturer of the Magic Flute.

Inquiry No. 5201.—For the manufacturer of a small check punch having stamped thereon the following: "Grabler's Patent, Jan. 7, 1902, U. S. A."

Inquiry No. 5202.—For makers of the quarters of a hollow sphere, to be made in sheet metal in sizes 8, 12, 16, 20 and 24 inches diameter of sphere.

Inquiry No. 5203.—For parties engaged in forming or bending spring wire.

Inquiry No. 5204.—For makers of small tanks made of copper and galvanized iron.

Inquiry No. 5205.—For manufacturers of chain hoists.

Inquiry No. 5206.—For manufacturers of boots.

Inquiry No. 5207.—For machinery for cutting wooden shoe pegs.

Inquiry No. 5208.—For makers of Tripoli stone, such as used in filters.

Inquiry No. 5209.—For parties to make small coils and strings of piano wire.

Inquiry No. 5210.—For makers of small steel chains the size of watch chains.

Inquiry No. 5211.—For small castings for boat engines and motors, of 2 to 5 h. p.

Inquiry No. 5212.—For makers of metal and cloth button machinery.

Inquiry No. 5213.—For makers of carrousels or riding galleries.

Inquiry No. 5214.—For an outfit of archery court.

Inquiry No. 5215.—For makers of small articles suitable for canvassing.

Inquiry No. 5216.—For manufacturers of card embossing and card beveling machines.

Inquiry No. 5217.—For manufacturers of pneumatic goods.

Inquiry No. 5218.—For makers of gas engine castings.

Inquiry No. 5219.—For makers of headless steel hat pins.

Inquiry No. 5220.—For makers of castings of every description.

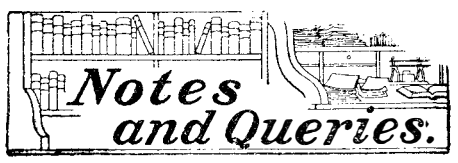
Inquiry No. 5221.—For the maker of a machine for producing quartered figures on plain oak lumber.

Inquiry No. 5222.—For makers of gasoline or hot air engines of about ½ h. p.

Inquiry No. 5223.—For a small hand loom for weaving rag carpets and looms.

Inquiry No. 5224.—For a device for cleaning cisterns of the shape of a common wooden bucket reversed, with a long handle attached, for extracting dirt from cisterns without removing the water.

Inquiry No. 5225.—For manufacturers of exhaust fans for ventilating purposes.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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(9324) W. I. R. says: Can you give me through the inquiry column of the SCIENTIFIC AMERICAN, a reliable formula for determining the number of square feet needed for steam or hot water radiators? A. The amount of radiating surface for steam heating varies considerably with the variable exposure of rooms. For house heating with low-pressure steam, in rooms with much exposure and windows on two sides of the room, a good rule is one square foot of radiating surface for each eighty cubic feet of room space, and for bedrooms of small exposure, one square foot steam surface to 120 cubic feet is a good rule. For halls and reception rooms, 1 to 100 is the general rule. For hot-water heating about 15 per cent larger than above surface should be supplied.

(9325) V. R. W. asks: Kindly inform me through your Notes and Queries whether or not molten lead when dropped in small quantities from a receptacle, from a great height, will form into spherical shapes while passing through space. A. Small quantities of molten lead when dropped from such a height that it will solidify before reaching the earth will be found to be in the shape of spheres. It is in this way that shot is manufactured. All drops of liquids are in the form of spheres.

NEW BOOKS, ETC.

MACHINE DESIGN.

We have received from the American School of Correspondence, Chicago, a copy of their new instruction paper on Machine Design. This paper has been prepared by Mr. Charles L. Griffin, who was formerly Professor of Machine Design at Pennsylvania State College, and has since had ample opportunity to put theory into practice, as chief draftsman of a prominent manufacturing company at Syracuse, N. Y. The results of his experience are clearly shown in the instruction paper. Mr. Griffin approaches his subject methodically. In fact, "method" is the key word of the whole paper, and characterizes its whole teaching. The student is first clearly taught the meaning of machine design and its relation to the problems it has to solve, viewed from the point of theory, and then from the point of production. With the relative and mutual importance of these points clearly in mind, the method of design is next taken up. The student is shown the importance of a complete analysis of the problem—its conditions and forces—before undertaking its solution. Then he must attack the problem theoretically, sketching out his design on scientific lines. The theoretical design when completed must be modified to suit practical requirements. Not until these steps have been successively followed out can the delineation and specification be taken up. These steps are clearly illustrated by a practical example, and the student is instructed to pursue them in every problem attacked, until they become so familiar as to be intuitively applied. Delineation and specification are just as methodically taught, and the student is thoroughly grounded in these important principles before taking up questions of mechanical construction and movement. The importance of such a method of attacking a problem will appeal to every experienced designer. In these days "system" plays a very important part in the success of business enterprises, and particularly in manufacturing concerns. It is a simple task to teach a new draftsman the "system" of one's drafting room, but quite a different matter to teach him a good system of thinking, a correct method of dealing with all questions which confront him, a "mechanical sense" which may be depended upon to result in scientific designing. It is a difficult matter to induce the draftsman to break away from his habit of guessing at proportions and dimensions without knowing their exact purpose or meaning. The time for learning a proper system of mechanical thought should, undoubtedly, come at the beginning of the student's course, before any guessing habits have been formed. We are pleased to find that the American School of Correspondence appreciates the importance of system in thought, and has given it due emphasis at the outset of the student's course.

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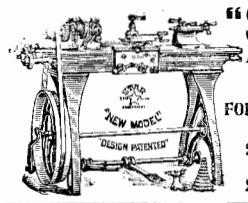

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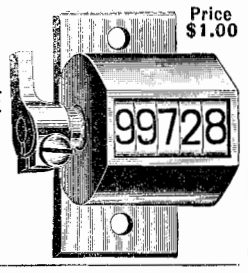

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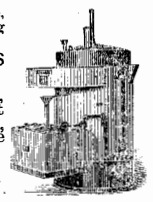

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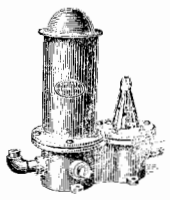

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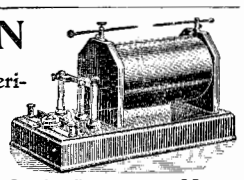

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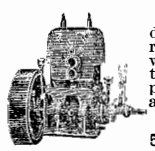

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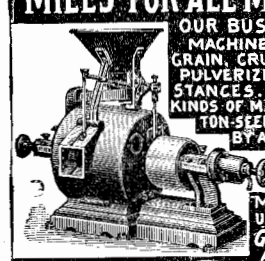

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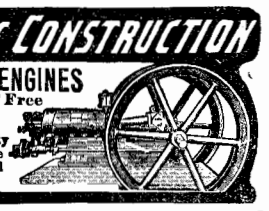

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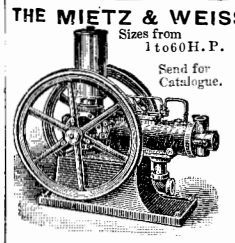

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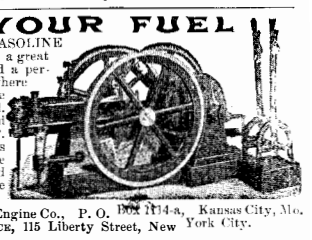

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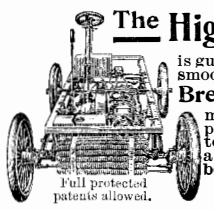

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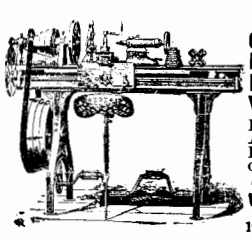

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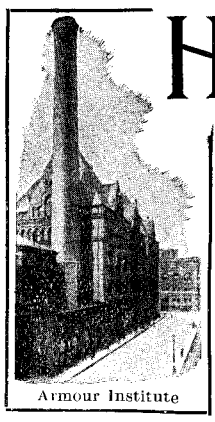

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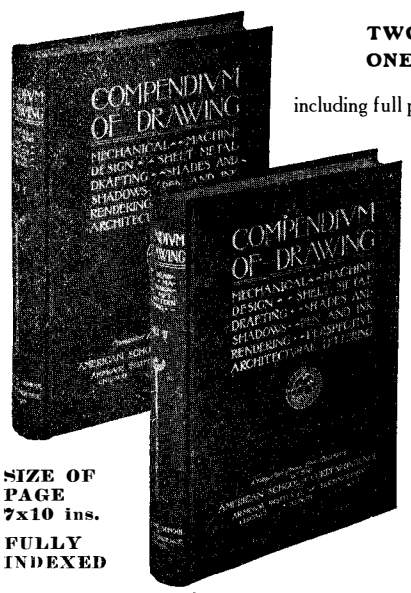

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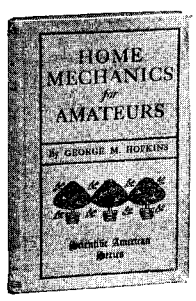

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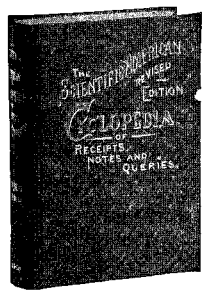

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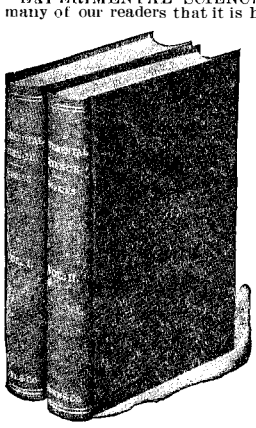

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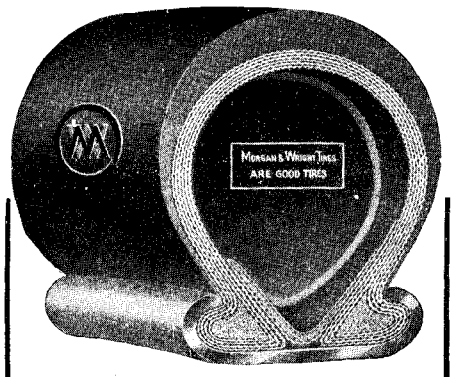

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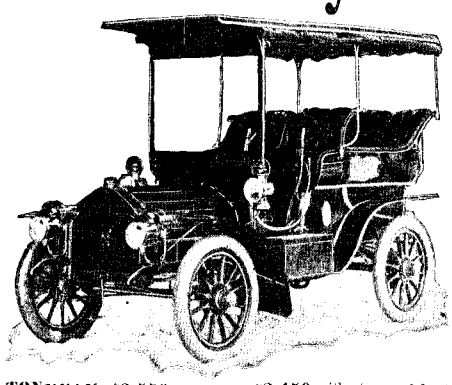

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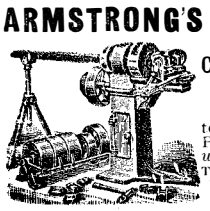

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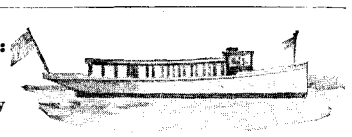

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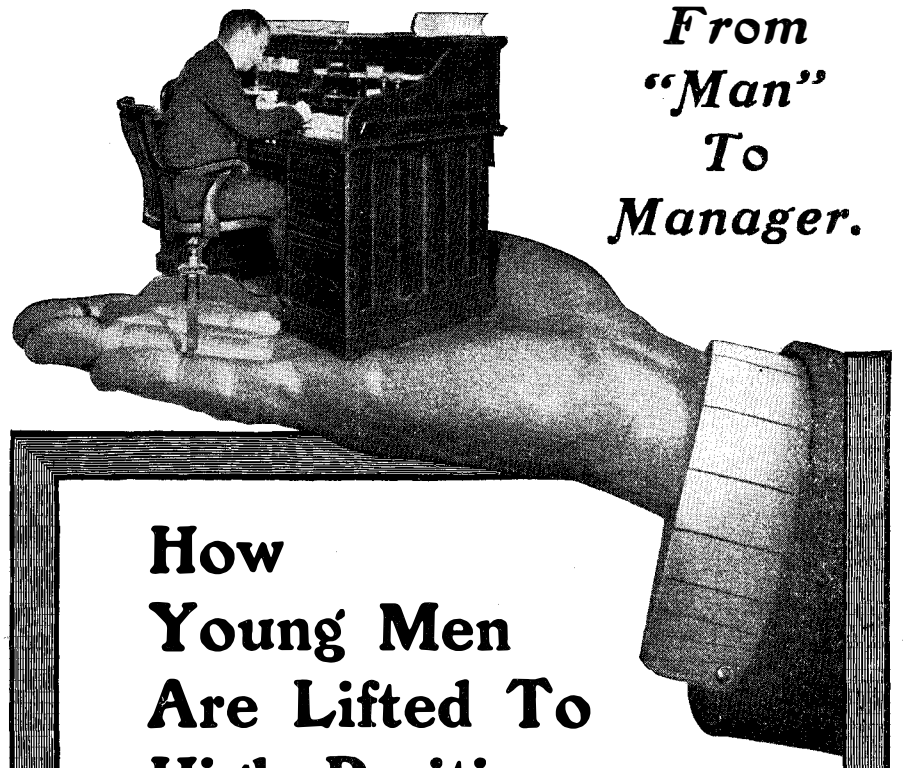

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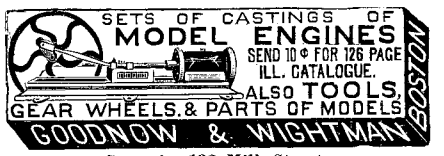

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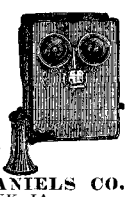

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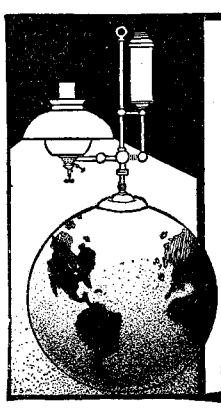

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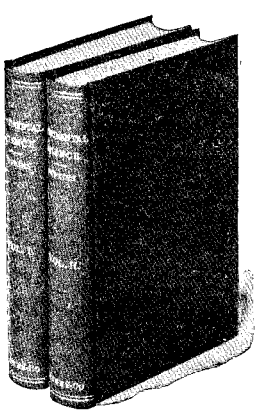

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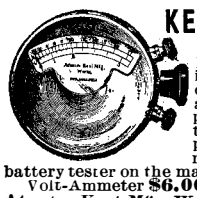

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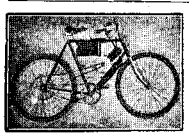

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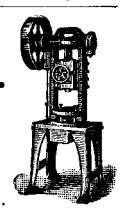

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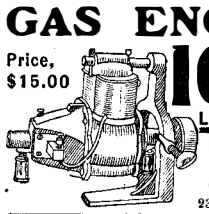

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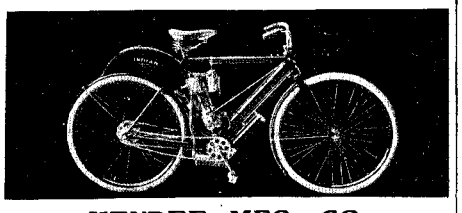

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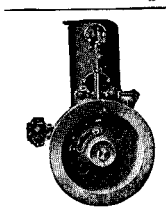

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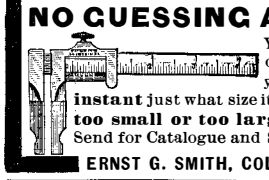

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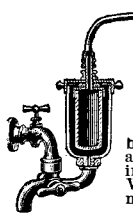

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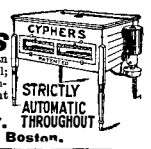

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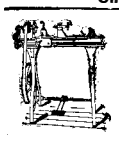

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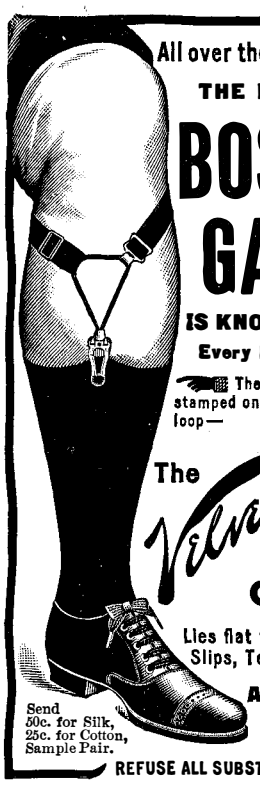

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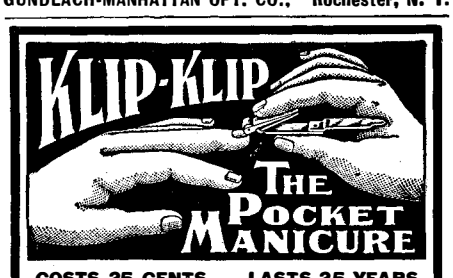

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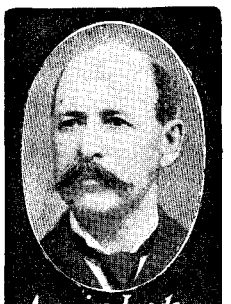

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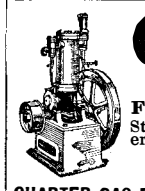

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4 Honors in one hand and 5th to partner's hand	18	36	54	72	
5 Honors in one hand	20	40	60	80	
Little Slam adds	20	20	20	20	20
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No trumps in one hand reduces Honors in adversary's	4	8	12	16	
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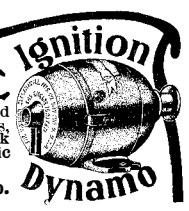

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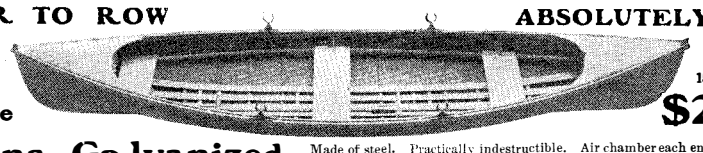

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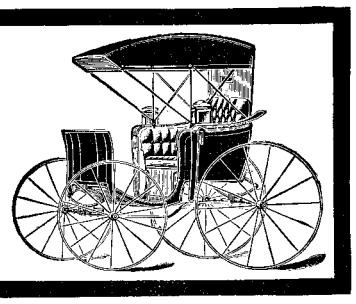

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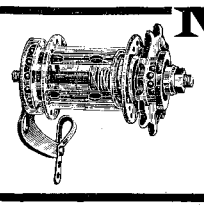

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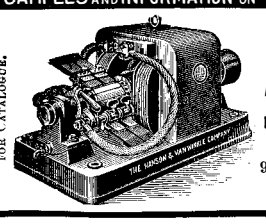

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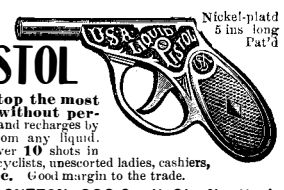

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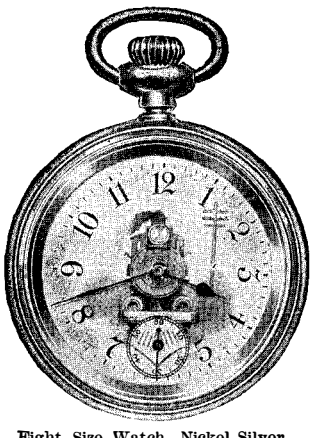

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